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UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT BULLETIN No. 863

Washington, D. C.

Issued September 30, 1920
Revised February 13, 1925

FORESTRY LESSONS ON HOME WOODLANDS

Rev.ed. follows

By

WILBUR R. MATTOON, Extension Forester, Forest Service

and

ALVIN DILLE, Formerly Specialist in Agricultural Education, States Relations Service

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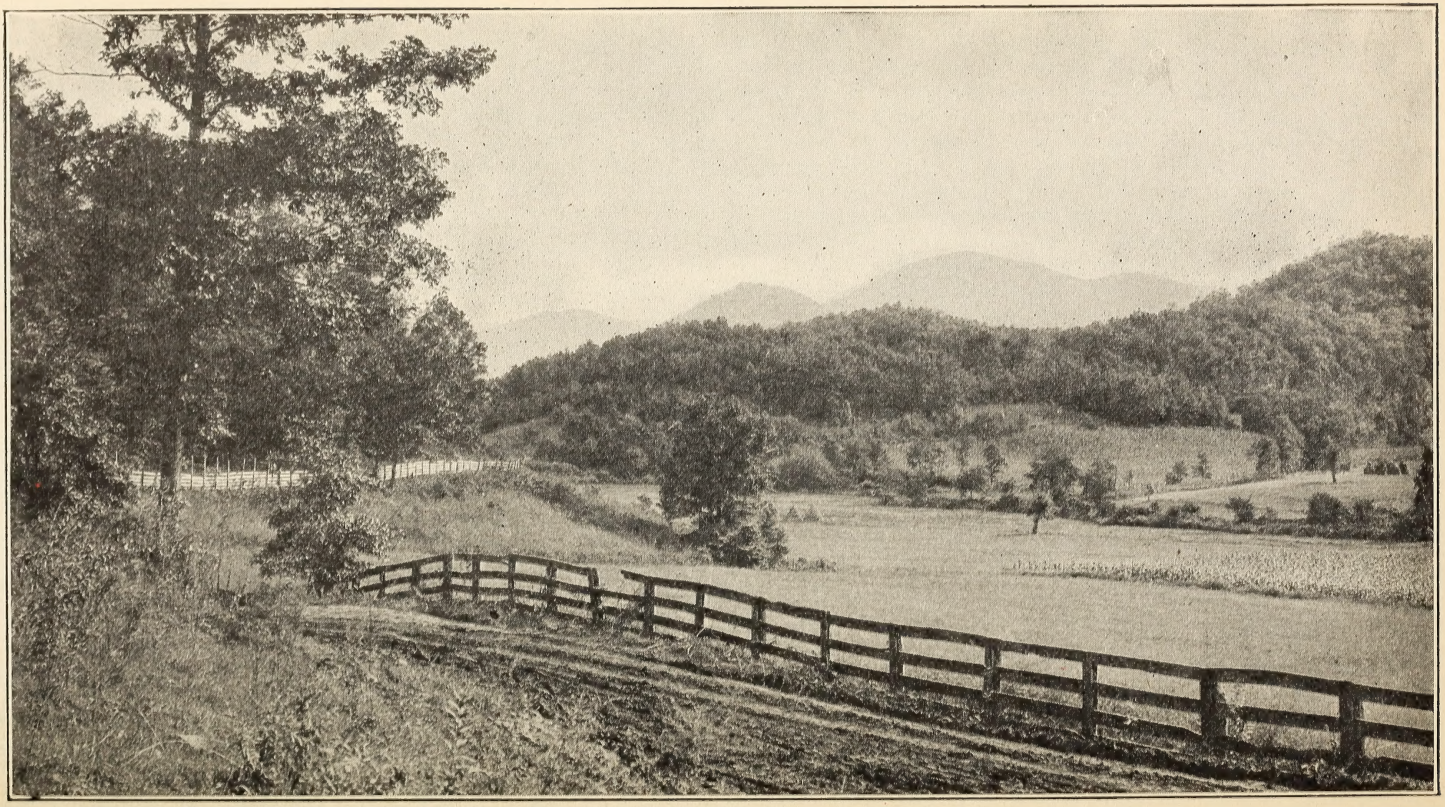

The home forest

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By WILBUR R. MATTOON, *Extension Forester, Forest Service*, and ALVIN DILLE, *formerly Specialist in Agricultural Education, States Relations Service*

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INTRODUCTION

The right handling of the home forest has come to be a matter of recognized importance in farm management. Farming touches forestry at a number of different points. The farm requires timber for the building and repair of houses, barns, sheds, fences, and telephone lines. It needs more or less wood for fuel, and it should have some woodland also for protecting the soil against erosion on steep slopes, for shelter for growing crops and livestock against the hot, dry winds of midsummer, the cold winds of winter, and likewise for the comfort of man and the home of game animals.

A farm without some woods is less attractive as a place to live and usually less valuable than one with at least a little woodland and some forest trees scattered about. Thus woodlands have a place both in the management of the farm and in the development of the community.

The lessons which follow present the subject of farm forestry from the standpoint of the important local kinds of forest trees and their uses, the proper location of woodlands on the farm, their economic value to the farm, the different farm timber products, measuring and marketing timber, utilizing timber rightly on the farm, protecting and improving woodlands, and planting young timber. A knowledge of farm forestry, applied along simple lines, should make farming more profitable. These lessons have been prepared to give to the

organized school work in elementary agriculture additional impetus in forestry, to provide material for instruction that is within the range of elementary pupils, and to furnish a topic for home projects that may be worked out profitably to every community and with real educational value to the pupils themselves.

SOURCES OF INFORMATION

Practically all the subject matter for class use and instructions for home projects will be found in bulletins available, either free or at a small cost. Almost every State agricultural college has published one or more bulletins on some phase of forestry, and in most instances these may be had for the asking. Address the dean of the agricultural college.

The Farmers' Bulletins of the United States Department of Agriculture referred to in this bulletin will cover many of the topics to be studied. Bulletins in this list will be sent free, so long as the supply lasts, to any resident of the United States, upon application to his Senator, Representative, or Delegate in Congress, or to the Office of Publications, U. S. Department of Agriculture, Washington, D. C. Because of the limited supply, applicants are urged to select only a few numbers, choosing those which are of special interest, and ordering but one copy of each. When the free supply has been exhausted, a number are yet for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each. Other publications of this department are also for sale by the Superintendent of Documents, but these are more often technical bulletins and of interest to those only who wish to specialize in the subject.

Frequently revised classified lists of department publications on different phases of agriculture, one of which is on the subject of forestry, are issued by the Division of Agricultural Instruction, U. S. Department of Agriculture, for teachers' use. The teacher will find that a number of the textbooks on forestry are suited to his needs, and that some of the elementary textbooks may be used by the pupils.

In addition to the Farmers' Bulletins and other Department Bulletins, the Forest Service issues a number of circulars on various phases of forestry which may be obtained directly from that bureau.

THE SURVEY

One of the means by which the teacher may become informed about the forestry interests of the district is a woodland survey. The pupils may assist in obtaining this information, but a first-hand knowledge obtained by the teacher will be a valuable aid.

This survey should include the kind of woodland, whether hardwood, conifer, or mixed type, the important species of trees in the forest stand, in respect to their abundance and their use and commercial value, the leading rough timber products that have been sold, and the prices received in the woods or shipping point. This information may be collected and tabulated.

A map of the district may be procured, or, if not available, one can be drawn on a large sheet by the pupils. On this map the homes and farms of the pupils are to be located. Place signs, emblems, or

colored bits of paper to represent various facts from your tabulations; for example, colored circles to represent young, middle age, or mature woodland, squares to represent timber products sold, etc. Additional facts may be placed on this map, taking especial note of the acreage per farm, interest in taking care of standing timber, etc.

ILLUSTRATIVE MATERIAL

Construct a chart showing the relation in size of crown and trunk of a typical tree growing in the open (limby) and a tree in a close stand (long, smooth trunk). Illustrate by a diagram the maximum wood production per acre and quality production of good timber by a crowded stand of trees and a thinned stand formerly containing more trees per acre.

Make drawings of the cross section of a tree trunk showing how the tree increases by a new ring of growth each year. Collect leaf specimens of the trees of the district and mount same on cardboard after pressing and drying them. Collect samples of the wood of the trees of the locality of approximately uniform size and mount them on boards, or hang them in frames or racks especially constructed.

If possible, obtain like specimens of the woods of other localities. These samples may be *classified and mounted into groups* such as hardwoods and softwoods, or oaks, maples, pines, etc. At least a small collection of such woods should be a part of the equipment of every school. Charts showing the relative importance and uses of the most abundant woods should be made.

Write to the Division of Agricultural Instruction, U. S. Department of Agriculture, Washington, D. C., for list of lantern-slide sets with lecture syllabi on the different phases of forestry. These sets of slides are loaned to teachers free of charge.

THE HOME PROJECT

It is agreed by teachers of agriculture that instruction in that subject should follow certain definite lines: (1) It should be seasonal. (2) It should be local in its interests and development. (3) It should meet the interests of the pupils. (4) It should be practical. The home-project plan affords the best means of meeting these conditions, especially the practical side. The pupil is working out for himself the principles and theories taught in the classroom.

The term "home project," applied to instruction in elementary and secondary agriculture, includes each of the following requisites: (1) There must be a plan for work at home covering a season more or less extended. (2) It must be a part of the instruction in agriculture of the school. (3) There must be a problem more or less new to the pupil. (4) The parents and pupil should agree with the teacher on the plan. (5) Some competent person must supervise the home work. (6) Detailed records of time, method, cost, and income must be honestly kept. (7) A written report based on the record must be submitted to the teacher. This report may be in the form of a booklet.

Type of forestry project.—A project in forestry must of necessity be of a much different type than a project in farm crops or animal production. The slow growth of forest trees and other factors in-

volved make it a project covering more than one season. However, forest projects can be conducted and made of much value to the student and community. Among the forestry projects that can be carried out, the following are suggested: The renovation of a farm woodland, the replanting of a woodland and subsequent care of the young trees, the planting of forest trees on some eroding lands or other waste ground on the farm, mapping and finding area of a forest tract, cutting and marketing farm forest products, giving especial attention to the proper cutting of trees and to the removal of the parts of the trees not marketed, a study and survey of forest fires, insect enemies, and the diseases of the common forest trees.

Lesson I. FOREST TREES AND FOREST TYPES

Problem.—To learn to know at sight the chief forest trees of the locality.

Sources of information.—Bulletins of the State colleges of agriculture and State foresters on forest trees; Forestry Bulletin 17; forest tree key and description of 100 important forest trees on pages 40–48 of Supplement. The Forest Service, U. S. Department of Agriculture, Washington, D. C., is ready to identify leaves, fruit, buds, and wood that puzzle the young forester.

Illustrative material:—The best illustrative material for this lesson is to be found in the woods, where the trees may be seen and their characteristics studied. In case this can not be done, pictures of typical trees may be used. Blackboard sketches showing the form of different trees are easily made and should be used in this lesson.

Topics of study.—Getting acquainted with the important kinds of forest trees in your locality. Their various common names and other names. A few trees are known widely by the same common name, but many are called by different names in various sections of the country. The importance of botanical names for certain identification. Distinguishing the different kinds or species of trees by some well-marked characteristics of leaf, bark, fruit, seed, buds, or twig arrangement.

Conifers: Trees bearing cones, such as the pines, spruces, firs, hemlocks, cedars, junipers, larches, and cypress. How do bald cypress and the larches differ from the others? Distinguishing characteristics of each group or genus, and something about its different members or species, particularly those that occur locally.

Hardwoods: Trees, most of which have wood harder than that of the conifers and broad leaves which are deciduous, or are shed in the fall. Kinds of hardwood trees which are evergreen. Group the hardwood trees into general groups, such as the oaks, maples, elms, and others, and identify as many different species of each as possible.

Kinds of trees which are associated together in different forest types, such as (*a*) ridge type, (*b*) slope or cove type, (*c*) bottom-land type, and (*d*) swamp type. What trees locally are associated to make (*a*) coniferous forest type, (*b*) pure hardwood type, and (*c*) mixed hardwood and conifer type.

Practical exercises.—Gathering leaves and fruit of the important local forest trees; press in wrapping paper, folded and labeled with place and date.

Studying the shape and size of leaves; trace a leaf of each of the important kinds of trees, and label with name, place where found, and date.

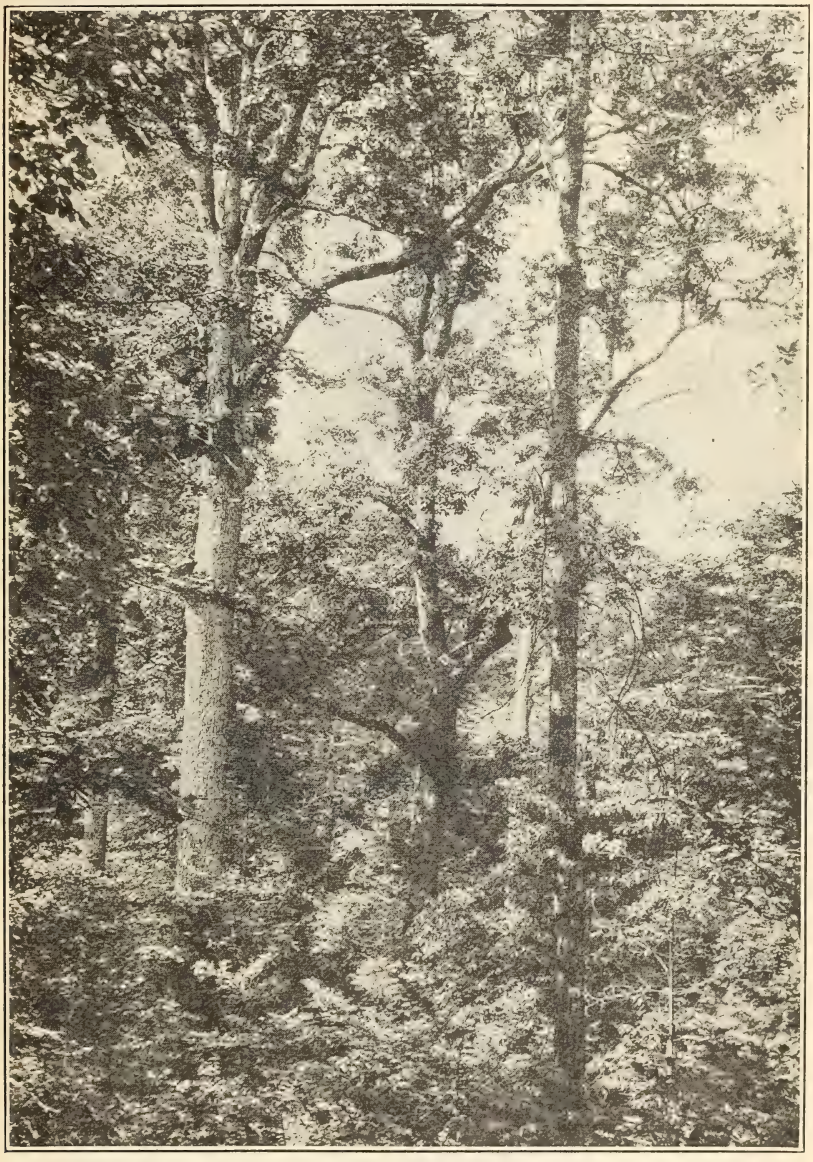

FIG. 1.—White oak, a woodland tree of wide distribution and high value, representative of the pure hardwood type

Grouping trees by kinds of fruit borne—nuts, keys, berries, cones, etc.

Collect samples of winter buds from leading kinds of trees, labeling with name of tree, place of collection, and date.

Study of winter buds, with drawings of buds and twig arrangement.

Collect tree blossoms from red and silver maples, willows, catalpa, elm, oak, dogwood, tulip poplar, basswood, buckeye, and magnolia.

Field study.[1]—Now to the woods, that you may come into personal touch with the forest trees of your own neighborhood.

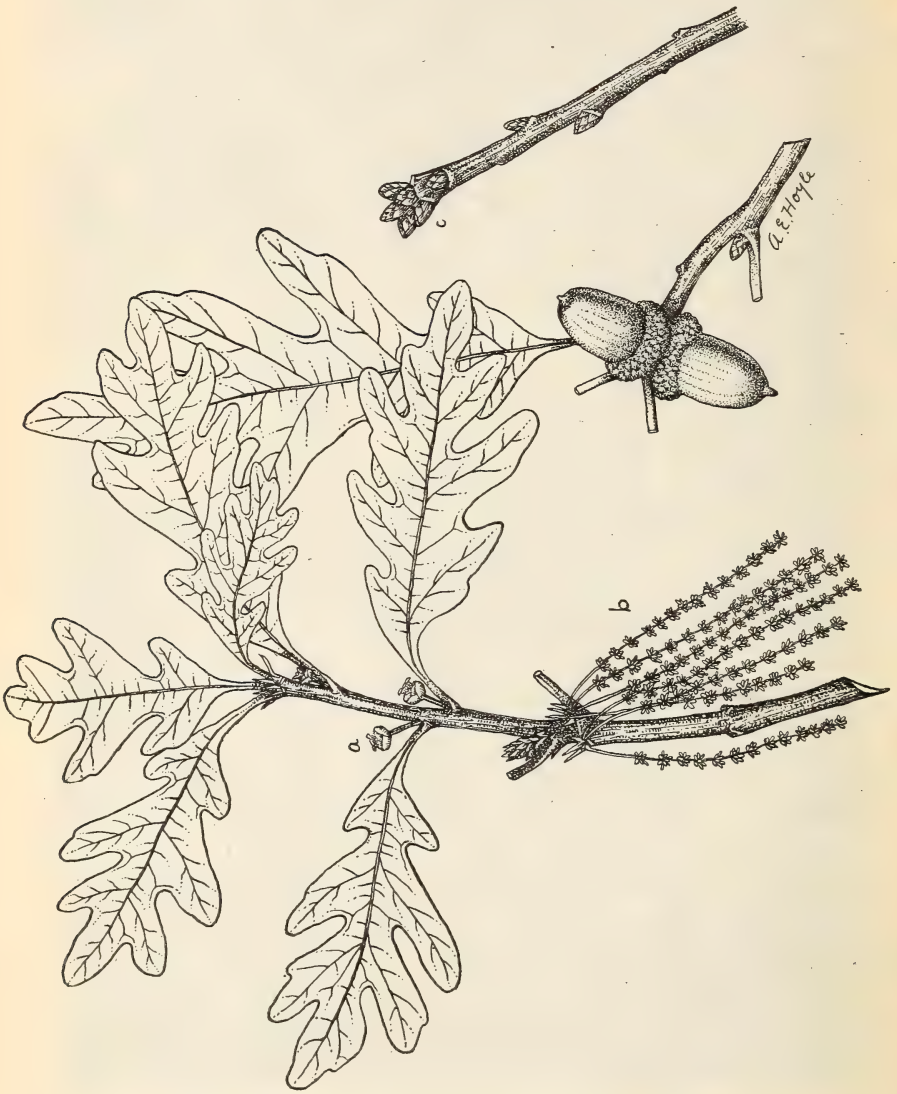

FIG. 2.—White oak leaf, flower, fruit, and winter bud: *a*, Pistillate or female flower; *b*, staminate or male flower; *c*, winter bud.

Leaves: The leaf is the trade-mark of the trees. Gather the leaves, study and compare them to gain a first knowledge of the trees as individuals, then as groups. The tulip poplar writes its name

[1] The sections on field study in Lessons I and III were contributed by Miss Lucy Kellerhouse, of the Forest Service.

plainly upon its square-cut leaf, but the boxelder has a leaf some what resembling the ash, though its seed is similar to the maple key. Wherein does the ash leaf differ from that of the locust or the hickory? The oaks are divided into the red and the white oaks. What is a typical leaf of each class?

You will probably begin this study in the autumn, so before the leaves fall and your memory of them fails press and either mount them or place in paper folders, and label with name, place where found, and date.

If the foliage of the black gum is now reddening, that of the red gum will also soon begin to color, and presently all the woods will seem as if on fire. The autumn colors will help to identify your trees and beautify your herbarium. A few of the broadleaf trees and all the conifers except the larches and bald cypress are evergreen. Separate the conifers into the pines, spruces, cedars, or other cone bearers of your woods, and divide into as many species as you find. Draw a diagram, and under the two heads, broadleaf trees and conifers, group the trees that you identify, with a short description of each.

Fruit: While you are gathering leaves, bring in the fruit, or seed, that you find—the pulpy fruit, nuts, berries, pods, winged seed, and tufted seed of the broadleaf trees and the cones of the conifers, and add to your herbarium.

Buds: As the leaves fall, gather the bare branches and study the winter buds that hold next year's leaves and flowers, from the big bud that tips the horse-chestnut to the long, sharp bud of the beech. Label them as you did the leaves.

Bark: The sycamore bark tells its own story, but do you know the bark of the elm from that of the ash? Contrast the glove-fitting bark of the beech with the rough-and-ready coat of the shagbark hickory.

Branches: Each tree has its own way of branching, though its form is not always so definite as the red cedar spire. What is typical of the white-oak bough? The leaves of the scarlet and the pin oak are considerably alike, but what is the character of each tree? Draw a leafless elm.

Flowers: When spring comes and the buds are bursting, do not forget the flowers of the forest trees. They form a clock dial for the advancing year. So, as they bloom in succession, bring in the blossoms of the willow, the maple, the elm, and the cottonwood, until you have gathered the last flower of June, and seed are on the wing.

While you have been getting acquainted with your trees, you have learned that they prefer certain localities; you have found the willow by the stream, the yellow or tulip poplar in the valley, the red oak on the higher ground, for one needs much moisture in its soil while another will grow in a drier situation. You have discovered that certain trees "hobnob" together because of similar requirements for soil, moisture, and light. In this way you will learn to group your trees into forest types when you begin your practical work as the forester of your home woodland.

Correlations.—Drawing: Sketch the different types of trees in the district; make drawings or tracings of the different shaped leaves. Mount these drawings and file with other illustrative material.

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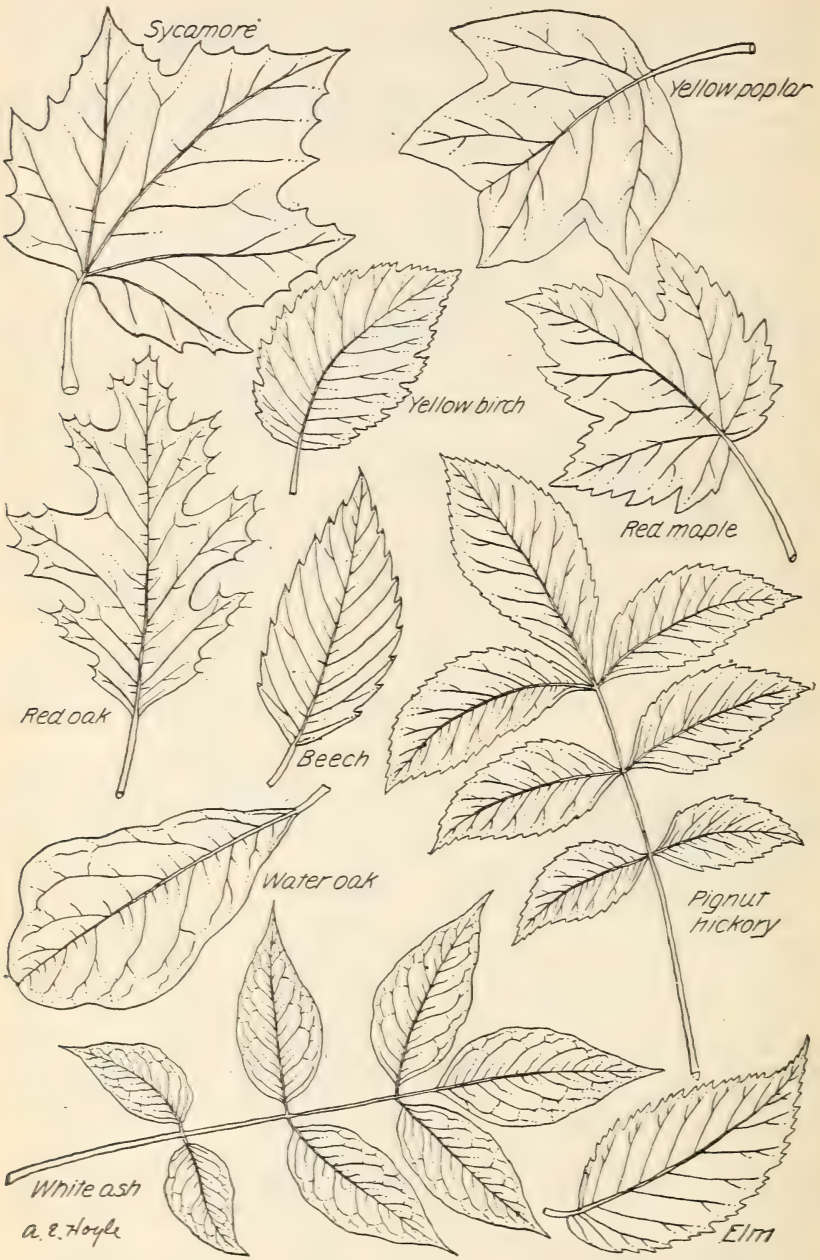

FIG. 3.—Leaf outlines of a few important species of forest trees. (Reduced—not to uniform scale)

Language: An account of a field trip carefully written will make a good English exercise. A tree booklet describing the different types of trees, telling where they are found, some of their characteristics and uses, illustrated by original drawings and neatly bound with an attractive cover page, will furnish an excellent drill both in language and in drawing.

Lesson II. LOCATION AND EXTENT OF WOODLANDS

Problem.—To study places about the farm where trees can be grown profitably.

Sources of information.—Farmers' Bulletins 358, 745, 1071, and 1117; Department Bulletin 481.

Topics for study.—Places about the farm where forest trees and woods should be kept. Timber is a poor-land crop. Places where forest trees are profitable: (1) Poor soils. (2) Steep slopes. (3) Eroding soils. (4) Rocky land. (5) Wet land. (6) Unused corners or waste places.

Extent of woodlands in the locality: Proportion of crop land and woodland. The total acres of woods on 10 to 20 representative farms in the locality.

Practical exercises.—From the data gathered in the survey construct a chart showing the proportion of crop land and woodland, the total crop acreage, and the total woodland acreage. Study the places where you find trees growing and list such locations as indicated in topics for study. What type of trees do you find commonly growing in each of these localities? What farms could profitably plant forest trees? What sort of trees should be planted in case a young forest is established?

Correlations.—Drawing: Draw a map of a farm or of the school district, locating the poor soils, steep slopes, eroding soils, rocky land, wet land, unused corners or waste land, and mark on this map the names of the trees that grow on these places or that could be profitably grown thereon.

Language: Write a report showing the advantages of using the poor soils and waste lands for tree planting, giving examples from the farms of the district if possible.

Arithmetic: Problems showing comparative acreage of crop land and woodland, and percentages of each, will be suggested in the study of this lesson.

Lesson III. ECONOMIC VALUE OF THE FOREST

Problem.—To learn the value of a forest as conserver of soil moisture, as protection against soil erosion, as a shelter against extremes of temperature, and as a means of increasing the farm income.

Sources of information.—Farmers' Bulletins 358, 715, 745, 788, 1071, and 1117; Department Bulletin 481; Yearbook Separates 688 and 886; Forestry Misc. F–I.

Illustrative material.—The best illustrative material will be found in a field trip to the woods and field. Actual examples of the use of the trees can be pointed out. If a field trip is not practicable, illustrations may be clipped from papers and magazines showing the

erosion on unprotected hillsides and the use of trees as shelters in pastures and about the farm buildings.

Topics for study.—With an acquaintance formed with the different species of trees, it will be worth while to learn their value both as individual trees and associated together in woodlands.

Timber or wood products: Trees, grouped according to their value for wood or timber. (This is expanded in Lesson IV.)

How a forest cover conserves the water from rainfall or melting snow.

Flow of streams from open and from forested land; seepage and springs. Protecting watersheds of city reservoirs and headquarters of large streams from erosion and floods. State and municipal

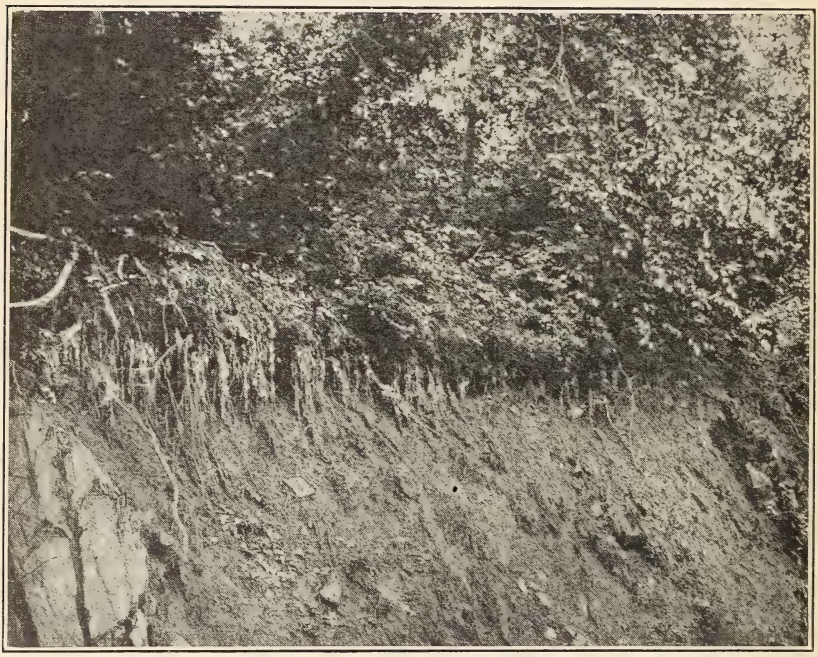

FIG. 4.—The forest floor. Leaves and twig litter on the ground beneath the trees, spongy layer of decomposed vegetable matter or humus, this and the lower layer of soil interlaced with tree roots and rootlets, and the clay subsoil. Dense growth of seedling and sapling trees covering and protecting the soil

forests. The 150,000,000 acres of Government national forests held for protection of watersheds and streams and for a permanent timber supply. Private owners hold four-fifths of the total standing timber in the United States.

How trees protect the soil against erosion and the formation of gullies on steep slopes. Examples of local hillsides and regions of the United States.

Effect of woods as shelter against hot dry winds and cold winds for growing grain and fruit crops, livestock, and the farm home. The difference felt in temperature of the air in midsummer out in the open road or field and in the shade of a single tree or of woods. The same as experienced on a cold windy day in winter.

Field study.—In an excursion with the teacher to the hills and fields the class can learn, by actual observation, the bond between the forest and the river.

As soon as the pupil leaves the open and enters the cool shade of the woods he will note the forest floor—the undergrowth of young trees and shrubs, the ferns and moss, and the litter of fallen leaves. With his jackknife, or a trowel, let him dig down beneath this cover into the mold of many years of fallen leaves. The soil will be spongy and moist. What happens when rain falls or snow melts? Under the shadow of the forest it sinks into the spongy earth. (Fig. 4.)

What becomes of the rain and snow that the forest has soaked up like a sponge? Find a spring. This is where the stored water is

FIG. 5.—Effect of deforestation. Washing of soil and devastion of valuable farm lands at the heads of streams

seeping out to feed the streams. The rainfall that has been held back in the hidden reservoir of the forest is here transformed into a steady supply of water for the pasture, the farm, the mill, and the city.

Let the class now return to the open and dig into the soil on the unwooded slope. It will be found dry and hard. What happens when the rain falls or the snow melts on the open hillside? It is not held back and absorbed but rushes down the slope. In a heavy rain the streams rise rapidly. Perhaps the class will find a bridge that has been carried away in a freshet. Some one may tell of the log bridge on the farm that was destroyed. Then what happens when the winter snow melts upon the unprotected mountain slopes and the spring rains swell the rivers? (Figs. 5 and 6.)

While the class is on the open hillside, places will be found where the soil, which has no roots to bind it, has been washed away by the rain, and on some steep slope there will be deep gullies dug into the ground.

Where does the soil go that is washed down the slope? Into the stream. Perhaps the stream carries the silt into the water supply of a city. If there is a river near, a sand bar may be found that has washed down from the hill country. What do muddy rivers mean to the harbors near the coast? Who has seen a dredge at work scooping up the silt to keep the channel free? This means a vast expense to the country.

The pupil who has noted these facts about woodland, soil, and stream will begin to see the relation which the forests of our country bear to the well-being of the land. The little examples that he finds in his own neighborhood of soil protection and good streams, of

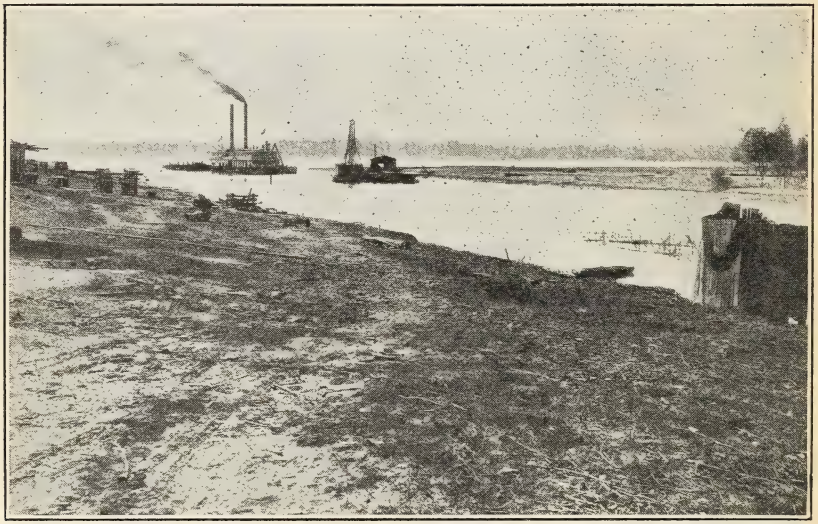

FIG. 6.—Effect of deforestation. Sand bars in the stream channels. Millions of dollars are spent yearly in dredging our rivers to keep them navigable

erosion and flood damage, are intimations of the larger meaning of the Nation's forests to farm land and industry and commerce. His own home woodland is a part of nature's plan to aid man and his enterprise.

Lesson IV. PRODUCTS FROM THE HOME FOREST

Problem.—What products from the home forest can be utilized by the farm both for home use and for the market?

Sources of information.—Farmers' Bulletins 516, 1071, 1117, and 1210; Department Bulletins 12, 605, and 753; Yearbook Separate 779.

Illustrative material.—Prepare a wall chart showing in a tabulated form the varous wood products. In each product column write the name of the tree or, better still, place a sample of the wood that furnished that product. Prepare another chart showing in like manner other timber products such as nuts, roots, bark, gum, and

edible fruits, listing the trees the same as in above chart. Any of the products from root, bark, gum, etc., will also make interesting and useful illustrative material.

Topics for study—Wood, in a rough state, is the principal farm timber product. What kinds of wood are used for the following rough products: (1) Saw logs; (2) poles and piling; (3) fence posts; (4) bolts, blocks, or billets for (*a*) cooperage, (*b*) implement handles, (*c*) wagon and automobile spokes, (*d*) pulp wood; (5) crossties; and (6) fuel wood. The sizes and other requirements for each of these various wood products, including the species of trees which are best suited and bring highest prices on the market.

Forest trees which produce nuts of commercial value; roots, bark, gum, and edible fruit. List of these products under each head and what they are used for commercially.

FIG. 7.—High-grade saw logs and rough stave boards cut from woodlands

Lumber is manufactured from the product of the woodland saw logs. (How to measure sawed lumber treated in Lesson VI.) That work is ordinarily done by the sawmill man rather than by the farmer.

Practical exercises—What is the chief use of wood in the district? What other forest products are made or used here? What trees furnish the greater amount of wood? What kind of lumber is sawed in the district? What becomes of this lumber? If there are any wood product factories in the district arrange for a trip to the same and study the various processes from the rough wood to the finished products. What timber in the district is most valuable? Why? An interesting study to make is the part forest products play in the construction of machinery, transportation lines, airplanes, etc.

Correlations.—Geography: Trace the timber products of the district to their market. In a like manner locate the source of timber products brought into the district and trace their probable route. On a State map locate the timber areas and learn, if possible, the

important kinds of trees in each area. Locate the great lumber regions of the United States. From what ports are forest products of the United States exported?

Arithmetic: Construct problems in which the prices of timber products are used. Use, if possible, the value of the forest products, the price of timber land, and prices of the miscellaneous forest products.

Language: Make a study of the forest products of the district and write a report of your study. Another report of value will be that on the forest products that are imported into the district.

Lesson V. USING FARM TIMBER

Problem.—To discover the right uses of farm timber.

Sources of information.—Farmers' Bulletins 516, 744, 1023, 1071, 1117, 1177, and 1210; Department Bulletins 718 and 753; Forestry Bulletins 80 and 144; publications of State foresters and colleges of agriculture.

Illustrative material.—Again a field trip will furnish the best illustrative material for this lesson. Note the height of the stumps where timber has been cut, the careless felling of trees causing the injuring of young trees, the tops and large limbs left in the forest. In the absence of a field trip, pictures may be shown illustrating the points mentioned above.

Topics for study.—The right using of timber on the farm should begin at the time the tree is cut. Waste of good timber in the woods is altogether too common nowadays, when wood is high-priced and getting scarcer.

High stumps mean usually that the best quality of the timber in the tree is wasted. Often the value of the timber left in high stumps is sufficient to pay for all the costs of logging. Saw logs can now be taken profitably from the tops which had to be left only a few years ago. Wherever possible the tops should be worked up into crossties, mine props, or firewood. By careless felling of trees much promising young timber is broken and destroyed.

High grade and valuable timber should not be used in places about the farm where less valuable woods will answer the purpose. Sometimes choice, white oak worth $40 a thousand feet in the log for veneers is split up into fence posts, or black walnut used for farm gates because it won't split. Substitutes can be found by children upon inquiry from their parents or neighbors.

Small and young timber cut in making improvement thinnings in overcrowded stands can often be sold or used on the farm for posts, poles, or firewood, instead of being allowed to decay in the woods.

Treating of fence posts: Short-lived woods when soaked in hot and then cold creosote last from 10 to 20 years as fence posts. As the supply of long-lived woods, such as black locust, osage orange, red cedar, chestnut, mulberry, and catalpa become scarce, treated fence posts are being increasingly used. Almost all farms have some common woods growing, practically all of which take coal-tar creosote readily.

Practical exercises.—In a field trip to the farm forests note what care is taken in felling trees, the disposition of limbs and tops, and the height of the stumps. What examples may be found where an

expensive wood is used that could be replaced by a cheaper substitute? What high-priced timber is found in the district? What is the common method of treating fence posts? How do telephone and telegraph companies protect their poles? What good and what bad example of the use of farm timber can you mention?

Correlations.—Language: Make a written or an oral report on the methods of cutting and handling timber on the farm, with especial reference to disposing of waste timber. Write a short account of the best methods used in the preservation of timber used in posts, railroad ties, and other lumber.

Arithmetic: Measure the height of stumps in a cut-over piece of timber and calculate the amount of lumber wasted. If one hundred 7-foot black walnut fence posts averaging 5 inches square in size can be replaced by 100 locust or red cedar posts of the same size, calcu-

FIG. 8.—Small pine logs cut in improving the woods by thinning

late, on the basis of local prices, the amount saved by the substitution. If creosoting a softwood post costs 15 cents each for treating but will make it last three times as long as one not treated, assuming average present local prices for labor in replacements and cost of untreated posts, what will be saved in 20 years in fencing a quarter section of land with posts spaced 12 feet apart?

Lesson VI. MEASURING AND ESTIMATING TIMBER

Problem.—How shall timber be measured and estimated?

Sources of information.—Farmers' Bulletin 1210; colleges of agriculture or State foresters' publications; rule for scaling logs, page 37.

Topics for study.—Measuring saw logs: Show how the diameter at the small end is found by measuring inside the bark along an average line, or two measurements taken at right angles and the two averaged. The diameter and length found, the approximate lum-

ber contents is found by referring to a copy of some log rule; probably the most common rule in use is the Doyle, although for small logs under 16 to 20 inches it is very inaccurate, because from one-third to one-half more lumber is usually sawed out than is indicated by the rule. (See Supplement, p. 37.)

How bolts and billets are measured. What makes a standard cord of wood?

Allowances made for defects in saw logs, bolts, or blocks, and in other material.

Estimating standing trees: Finding approximately the contents of standing trees in cords or board feet of lumber by measuring the diameter at breast height (4½ feet above the ground), estimating or measuring the number of 16-foot log cuts in the tree, and by the information given in Farmers' Bulletin 1210. Find the merchantable contents of the tree expressed in board feet.

FIG. 9.—Measuring and estimating the saw timber in a stand of short-leaf pine

Estimating whole woods: Applying the same method to all the trees on a measured one-tenth or one-quarter acre, and thereby estimating the contents per acre. Recording the measurements by different species on a simple blank form ruled in squares in two directions.

Practical exercises.—This lesson should be essentially one of practice. The class should measure logs according to the Doyle rule, standing trees by the use of volume tables for trees, and cordwood by dimensions of the piles. A good exercise for the more advanced students is to make estimates on logs and standing trees and then by applying the Doyle rule or the volume table test the accuracy of the estimates. The practical value of this lesson is in acquainting the pupils with comparatively easy ways by which they can measure logs and cordwood and estimate the amount of lumber or cordwood in trees.

Correlations.—The operations mentioned in the practical exercises will afford abundant work in calculations and suggest a varied list of arithmetic problems.

Lesson VII. MARKETING FARM TIMBER

Problem.—How shall the farm timber be marketed to the best advantage.

Sources of information.—Farmers' Bulletins 1100 and 1210; bulletins of the State colleges of agriculture and State foresters.

Illustrative material.—Timber price lists. Addresses of firms dealing in timber. Local prices for cordwood, posts, crossties, and piling.

Topics for study.—Finding the best markets: Before timber is cut its approximate size and amount by species, and its disposal should be determined as definitely as possible. How to find buyers of cut-timber products. How are logs, bolts or billets, piling, posts, crossties, and firewood generally sold? Advertising in the newspapers, consulting neighbors who have recently sold timber, consulting State foresters and reliable experienced men.

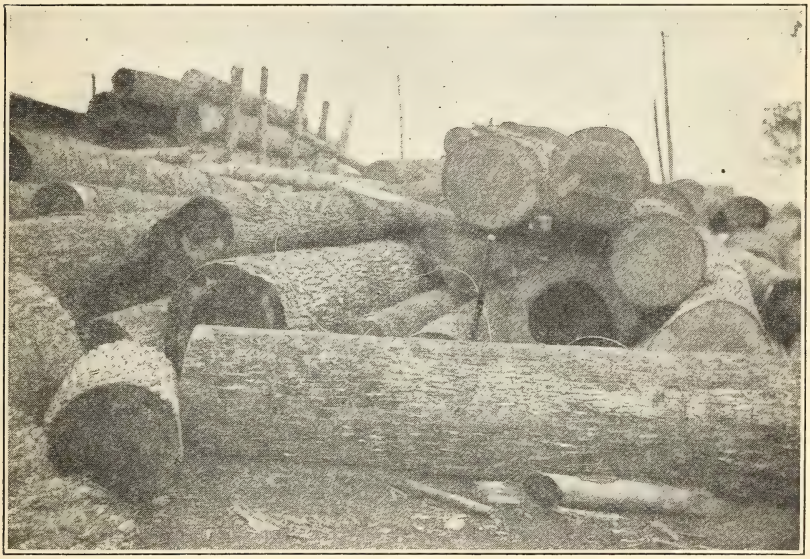

FIG. 10.—The best timber brings high prices and can usually be shipped for veneer or quarter-sawed lumber. Several owners can join in marketing a carload lot

The owner protecting himself by a simple form of written contract: Much loss comes to sellers of timber products by failure to observe this precaution and to have the agreement in proper written form.

Selling timber standing: Selling for a stated sum by the acre, or a lump sum for the whole tract or "boundary."

What to sell and what timber to keep growing in the woods; what timber to sell and what to use at home. Choice logs of certain woods bring high prices and can be profitably shipped long distances by rail or water.

Cooperative marketing of farm timber: Carload lots of logs, etc., the least amount that can profitably be shipped. Many wood manufacturing concerns buy direct from producers in carload lots.

A farmer may not have sufficient white-oak saw logs or hickory spoke blocks to pay to ship.

Practical exercises.—What timber is being sold in the district? Who is buying it? To what place is it being shipped? What standing timber is sold in the district? What cooperative shipping of timber do you find? Visit a wood yard and note methods of handling the wood and get prices per cord on the different sizes of wood.

Correlations.—Abundant exercises in arithmetic will be suggested by the prices of timber and amounts sold. If a price list of timber and its products at the final market can be had, some interesting problems can be worked out by comparisons with local prices.

For a language exercise make a report on the various kinds of timber marketed, prices paid, methods of transportation, and markets.

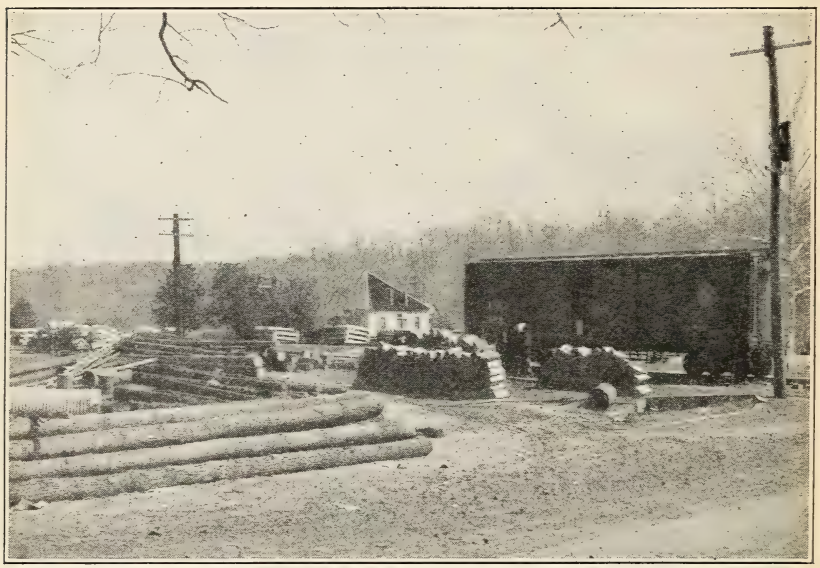

FIG. 11.—Oak spoke blocks, piling, and cross ties ready for shipment

Lesson VIII. PROTECTING THE WOODS

Problem.—To learn the best methods of protecting woodlands, and to discover the kind and extent of injury or loss due to forest fires.

Sources of information.—Farmers' Bulletins 173, 1177, and 1188; Forestry Circular 205; Department Bulletins 308 and 787; Yearbook Separate 548; State publications. The United States Department of Agriculture and the agricultural colleges will be glad to render assistance by identifying and furnishing information concerning various forest insects and plants.

Illustrative material.—Pictures of forest fires, burnt over woodlands, forest rangers, their camps and equipment, copies of the United States Forest Regulations, and charts for fire prevention will make excellent illustrative material. Pictures of trees damaged by insects or fungi, samples of damaged wood, samples of insecticides and materials used to prevent insects from damaging trees should also be used.

Topics of study.—Fire, the arch enemy of the forest: It kills large numbers of the smaller trees and kills or weakens the vitality of the older trees; the humus layers over the ground are destroyed. The loss of the protective covering exerts a marked effect in causing the soil to dry out and become hard as a result of which the rain is shed off rapidly following dry weather, much as when it falls on a house roof. Trees in farm woodlands and city parks are often seen dying at the tops, most usually from this cause.

HELP

PREVENT WOODS FIRES.

BE SURE your match is out before throwing it away.

DON'T throw away burning tobacco.

CHOOSE a safe place and make your camp fire small.

PUT OUT your fire with water and then cover it with earth.

DON'T make large brush heaps. Choose a still day for burning and plow furrows to protect near-by woods.

BE CAREFUL WITH FIRE.

Forest rangers employed by the States and Government for the administration and protection of the State and national forests. What type of men are required for forest rangers whose duties require them to live out of doors and ride or work in all kinds of weather? Each national forest divided into districts in charge of rangers. Fire-protective plans worked out in great detail for detecting and fighting fires as soon as possible after they start. Fire-fighting equipment, such as lookout peaks and towers, telephone lines, and fire-fighting tool boxes at convenient points over the forest. Airplanes and radio also have their uses.

Protection for State forest lands by similarly organized methods. Federal cooperation with the various States authorized by the Weeks law, for the protecting against fire of headwaters of navigable streams.

The grazing of livestock has much the same effect in removing the protective covering and packing the ground hard. Cattle and horses browse off the tender young seedlings and tramp down the upper soil layers. Sheep and goats are very destructive to young seedlings, particularly when closely herded. Hogs feed upon most kinds of acorns and nuts, although by rooting up the leaf litter they sometimes favorably expose the mineral soil for the quick germination of tree seeds. Hogs are very destructive to the seed or mast of the long-leaf pine, and the young seedlings are killed in large numbers by animals stripping off the thick, sweet, spongy bark from the roots.

Damage by insects: Leaf and inner bark-eating, twig-cutting, bark and wood-boring insects. Methods of checking spread of insect infestation by right methods of cutting.

Fungi in forest trees as a source of the dying and injury of many trees. Some trees more immune than others. Importance of keeping

FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE
PREVENT
FOREST FIRES
Start camp fires only in safe places and extinguish them completely before leaving. Put out any fire discovered or report it to the nearest Forest Officer. The Laws provide heavy penalties for wilful or careless setting of forest fires. A reward will be paid for information leading to conviction of offenders.
Form 986

FIG. 12.—One of the fire signs posted widely in the national forests

woods in a healthy growing condition and rightly cut in order to combat the spread of fungus diseases.

Practical exercises.—What damages to woodlands occur in the district? What forest protection in use in this locality? Do you find any disease or insect attacking any special group of trees? Are farm animals allowed to graze in farm woodlands? If so, what damages do you notice?

Lesson IX. IMPROVING THE HOME FOREST BY CUTTING

Problem.—How to improve the home forest by proper cutting.

Sources of information.—Farmers' Bulletins 1071, 1117, and 1177; Forestry Bulletins 92 and 96; Department Bulletins 11, 13, 139, and 308; Forestry Misc. R–3; State foresters' publications.

Illustrative material.—Charts or illustrations showing results of overcrowding and of proper thinning out of forest trees. Pictures showing results of careless felling of trees. If possible, visit a forest where these results can be actually shown by observing rings on stumps or cutting into trees that have been several years previously thinned. In an even-aged group, note different sizes of trees of same age as result of differences in growing space.

Topics for study.—Cutting the individual tree rightly; why as little as possible of the tree's stump and top should be left in the woods; careful felling of trees. What is liable to happen to trees injured by another falling?

Thinning out overcrowded stands of forest trees. How fewer and fewer trees can grow on an acre as the trees increase in size. Available light supply for growth. Purpose of thinning to utilize timber that would otherwise die and go to waste. Also to stimulate the remaining trees to increased growth, which means increased value.

Improve the woods by proper cutting, taking out (1) the mature, (2) broken, crooked, diseased trees, and (3) the slow-growing and less-valuable species of trees. Most woodlands have many such trees crowding out young, promising trees of the better kinds. Making woodlands yield a profit on the investment, increasing farm income and the selling value of the farm.

Practical exercises.—The facts taught in this lesson should be verified by actual observation in trips to forests. Study first hand the results mentioned in the lesson. A good project would be the improvement of a forest plat by proper thinning, including the removal of diseased, defective, overcrowded, and dead trees, and undesirable species.

Correlations.—The class in drawing may construct the charts mentioned under "Illustrative material." They should also make drawings of trees showing development under adverse conditions and of others under proper conditions.

Language: A survey of the general practice of home forest improvement of the district with a written report of the same will afford a very good exercise in language.

Geography: A district or county map locating the farm forest areas and designating those under improvement. An outline map of the State locating the farm forest areas.

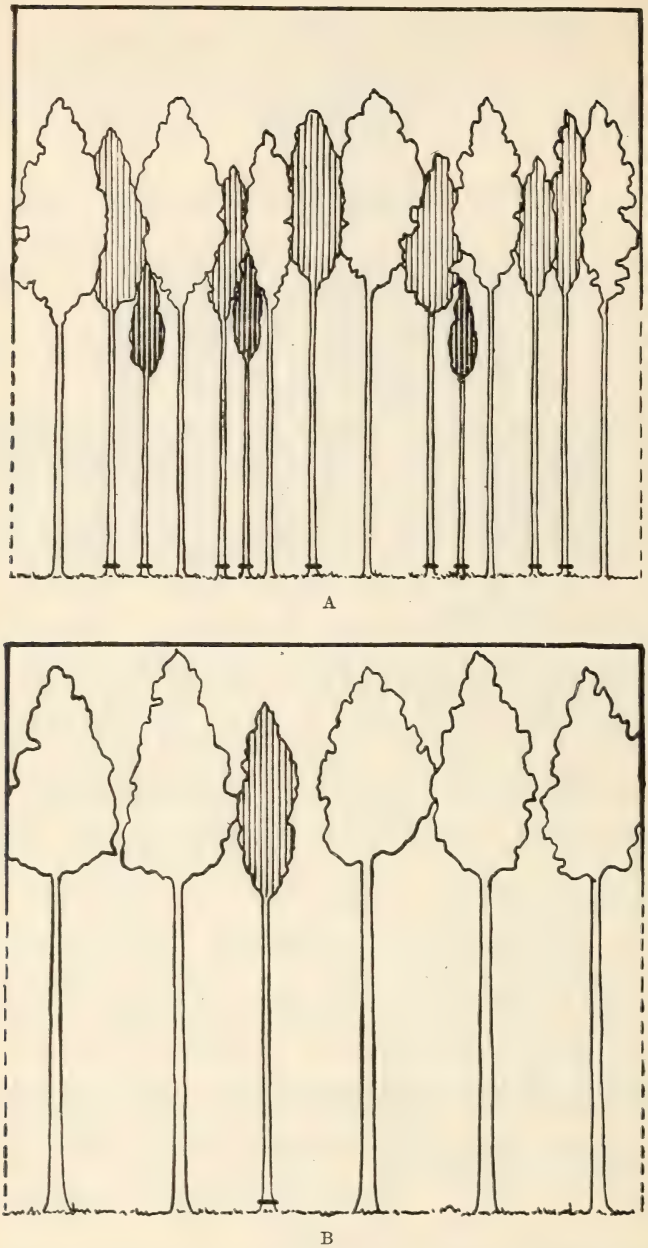

FIG. 13.—The growth and value of pine are increased by repeated thinning. The trees removed can generally be used or sold profitably for firewood, treated fence posts, or small timber. A, Before thinning. Fifteen overcrowded trees (shaded trees to be cut). B, The same stand five years after thinning. Six larger and more valuable trees (shaded tree to be cut)

Lesson X. GROWTH OF TREES AND FORESTS

Problem.—To learn how trees and forests grow.

Sources of information.—Farmers' Bulletins 134, 173, and 1071; Forestry Bulletin 92; Department Bulletin 308.

Illustrative material.—Potted seedlings, pots or boxes, and seeds of trees. A chart showing roots, stem, and leaves of a tree. A chart,

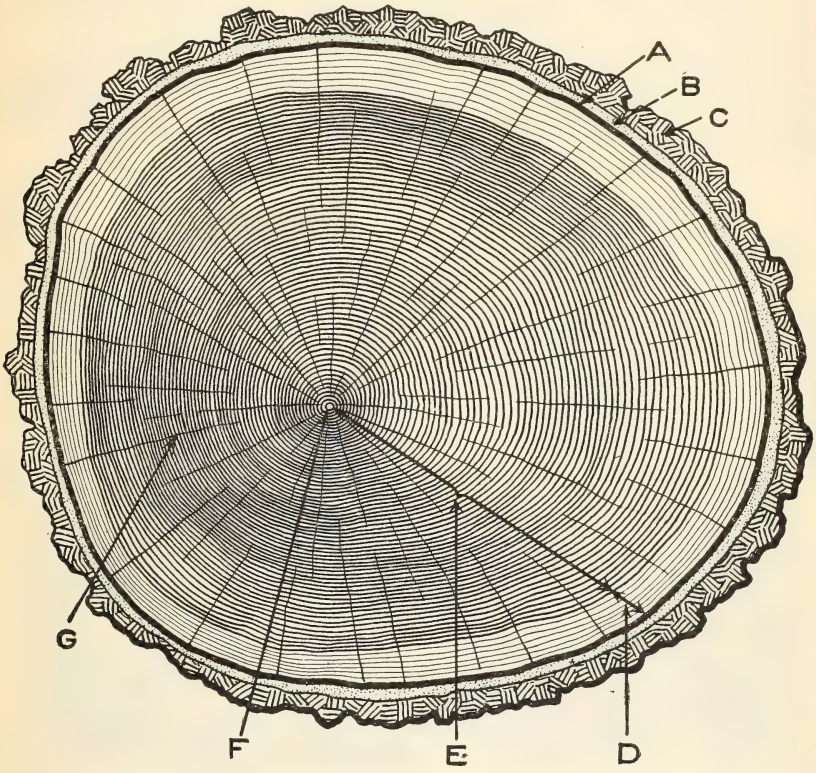

FIG. 14.—How the tree trunk grows. All growth takes place in the cambium, lying between the inner bark and sapwood. This is a very thin layer of living cells which divide and subdivide, forming on the outside bark and on the inside wood (A). The inner bark, or last tissue, is soft and moist. Its function is to carry the food prepared in the leaves to all growing parts of the tree (B). By a gradual change the inner bark passes into outer bark, a corky layer composed of dry, dead cells. This serves to protect the living stem against evaporation and mechanical injury (C). The woody growth during one season is called an annual ring. In the spring the newly formed cells are thin-walled and spongy, while in midsummer and fall the walls of the cells become thicker and denser. This difference can be distinguished in many kinds of trees as light-colored spring wood and darker colored summer wood. Sapwood (D) is the lighter colored band of wood beneath the bark, often from 1 to 2 inches thick. It carries the sap from the roots to the leaves. Heartwood (E) is formed by a gradual change in the sapwood by which it becomes darker, heavier, and often more lasting. Most of the trees, but not all, form heartwood. Pith is the soft tissue on the innermost part of the stem, about which the first woody growth takes place in the newly formed twig (F). From it extend the pith rays (G). These are flat, vertical bands of tissue which connect the pith with the various layers of wood and the inner bark. They transfer and store up food

or better, an actual cross section of a tree stem showing different parts of the stem, such as annual rings, heartwood, sapwood, bark, and cambium. Leaves mounted so that their structure can be studied. Branches showing bud and twig arrangement. Drawings showing shapes of crowns of trees grown in the open and grown in close stands.

Topics for study.—The life of a tree and why it is necessary to know something about how trees live.

The leaves, trunk, and roots, and function of each in the tree's existence. How the tree breathes and gets its food from the soil and air; what travels upward and what downward in the branches and stems. Structure of the leaf and different parts of the trunk.

How the branches lengthen and the tree trunk increases in size; the location, color, and structure of the living tissue or cambium layer. What are annual rings, heartwood, and sapwood?

Requirements for growth: Air, light, moisture, and heat.

Trees in association—a stand. Influence of trees upon each other. Difference, if any, between shape of crowns of open-grown trees and those grown in close stands. Influence of different light and soil-moisture supply.

FIG. 15.—Effect of light supply upon the form and commercial value of trees. A, Elm which grew up among other trees of the same height but since cut down. Clear trunks make valuable lumber. B, This elm grew standing in the open. Trees with short limby trunks are useful chiefly as firewood

Effect of tree density (number of trees in a given area) upon growth of the individual tree. Natural dying out of trees in close stands with advancing age. Understocked, well-stocked, and overstocked stands and the production of (*a*) saw timber and (*b*) cordwood per acre under each condition.

Practical exercises.—Make the following tests to show requirements for growth: Place a potted forest tree seedling in the dark for a few days; withdraw moisture from one and supply moderate amounts of moisture and excess moisture to other seedlings; subject plants, if possible, to different degrees of heat. Note results. Erect a pole or 1 by 2 inch timber strip close beside a young, thrifty sapling pine or hardwood. At regular intervals of a week or month, mark on it the total height of the growing tree. Keep a record also of the dates and measured heights.

Lesson XI. FOREST REPRODUCTION

Problem.—To learn how trees reproduce themselves.

Sources of information.—Farmers' Bulletins 134, 173, 423, 788, 1071, 1123, 1177, 1256, and 1312; Forestry Bulletins 45, 121, and 244; Forestry Circulars 45, 81, 99, and 208; Department Bulletin 153.

Illustrative material.—Make a collection of seed specimens of the classes indicated under "Topics for study." Either mount these seeds on cardboard or put them in wide-mouth bottles. Clip pictures of young forest growth.

Topics for study.—Seeds: The various devices of nature for dispersing the seed widely. Tree fruits with (*a*) wings, plumes, etc.; (*b*) pulpy fruit with bony seeds sought by birds; (*c*) rich nut kernels liked by rodents and birds, and often buried or otherwise stored away; (*d*) light seeds which float or roll along the bottom of streams. Species of trees whose seeds are (*a*) carried by wind, (*b*) water, or by (*c*) birds and animals. (Fig. 16.)

Sprouts: Different species of trees which reproduce themselves by means of sprouts from stumps. From what part or parts of the stump do sprouts arise? Species which sprout from surface or lateral roots. Influence of the season of the year when cutting is done upon the vigor and growth of sprouts. Influence of age of parent tree upon success of sprouting.

Natural forest reproduction: Young growth. (Fig. 17.) Conditions under which young growth starts in woodlands. A forest without young growth is like a community without children—it will die out. Need for large numbers of young trees for perpetuation of the forest. Competition and shading out of the weaker seedlings and saplings.

How the forest travels: (*a*) By wind; (*b*) by animals, birds, and water. (Fig. 16.)

Age groups of young growth: (*a*) Seedling, (*b*) small sapling, (*c*) large sapling, (*d*) small pole.

Starting a young forest by direct seeding or transplanting nursery-grown seedlings. Sowing the seed direct where the trees are wanted. Kinds of trees started this way: Usually the species difficult to transplant on account of large, deep taproots, such as hickories, walnuts, some of the oaks, longleaf and some other pines. Collecting the seed. Storing the seed over winter. Sections of the country (north) where seed sowing is best done in the spring and (south) where it may be done in the fall or early winter. Preparation of the soil and method of planting seed of different kinds. Care of growing seedlings.

Planting seedlings grown in nursery beds. Preparation of nursery beds and sowing of seeds. Kinds of trees commonly raised in nursery beds. Age of seedlings fit for planting. Need for transplanting seedlings in nursery prior to planting out in the woods or fields. Season of year for successful planting and method of planting. Sources of injury or loss, and means of combating. (Fig. 18.)

Regions where forest plantations are needed and commonly started. Purposes for which plantations are set out. Kinds of trees profitable in plantations. Pure and mixed plantations, and advantages of each.

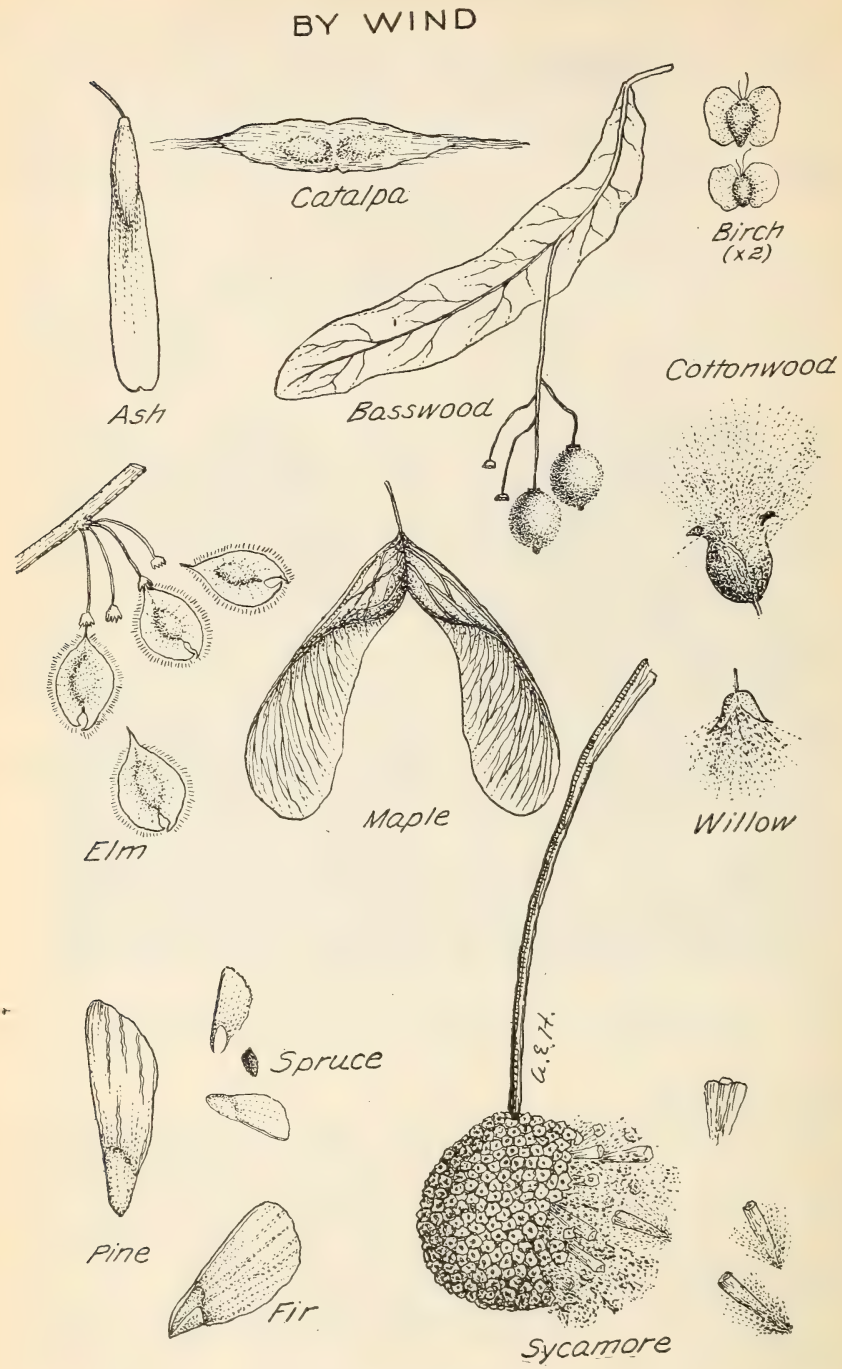

FIG. 16.—How the forest travels: By wind

BY ANIMALS

Hickory
Walnut
Butternut
Oak
Honeylocust
Persimmon
Beech

BY BIRDS

Redcedar
Cherry

BY WATER

Cypress
Tupelo gum
Cottonwood
Willows
Maples
etc.

FIG. 16.—How the forest travels: By animals; by birds; by water

Planting steep slopes and eroding soils with forest trees to check soil wastage and land destruction. Kinds of trees suitable for taking hold quickly and multiplying on such dry banks.

Filling up large openings in the woods and improving existing woodlands by planting desirable species of trees.

Utilizing poor soils and so-called waste places about the farm by planting quick-growing, useful kinds of trees: Black locust for fence posts, pine and other species for use as treated fence posts.

Trees about the farm and farmstead for shade, nut production, and ornamental purposes.

FIG. 17.—Woods with plenty of young growth coming on to take the place of the larger trees when cut

Lesson XII. WOODLANDS AND FARM MANAGEMENT

Problem.—How may the home forest be best managed to make it more valuable, to increase the farm income, and to make the farm more desirable?

Sources of information.—Farmers' Bulletins 635, 745, 1071, 1117, 1177, and 1210; Department Bulletin 481.

Topics for study.—Review importance and value of woodlands to the farm. The uses of timber on the farm, and importance of having home-grown timber close at hand.

Increasing the farm income by marketing the choice grades of logs and other rough wood products not needed for home use.

Woodlands making farms more desirable and salable than similar farms without timber. The actual value of the timber and the additional indirect or æsthetic value because of attractiveness, a

place for the owner to recreate in, or a cover for small game. People have an inherent fondness for the woods. How the occurrence of woods makes the community a better one in which to live.

Increasing or reducing the area in woods to the point of right proportion of cropland, pastureland, and woodland. The soundness of the farm policy of having permanent woodland on the farm. Proper area in permanent woodland. Kind of soil, topography, and amount of forest land in the locality, and their effect in determining the area of permanent woodland.

FIG. 18.—Forest plantations are made with small seedlings and no later watering or cultivation are necessary. Fire and grazing stock must be excluded

Waste or idle land, poor soils, steep slopes, wastes and gullies, rocky and wet lands (fig. 19) made profitable by growing timber.

Handling woodlands so as to keep them at the highest point of production. Overcutting and its ill effect upon the productive power of the forest. Owners to be satisfied with a permanent revenue from the woodland. Difference between a mine and a forest in respect to their producing power.

Woodlands as a source of permanent revenue on the farm. Differences between a timber tract containing thrifty young trees and one with only scattered old trees and much sod and shrubs. The forest capital—the stock of growing trees—must not be too heavily cut. Because of the desire for ready money, there is constant danger of this happening. The apparent returns may be increased for a few years, while the productive capacity of the forest is being reduced below the minimum limit. This point, below which the total amount of growing timber should not be allowed to fall, is about one-

half the contents of a fully stocked stand at maturity. If the latter, for example, is 40 cords per acre, then the woods should never contain less than about 20 cords per acre as the growing stock or basis necessary to secure the maximum production. This does not apply to mixed hardwoods cut clean and renewed by sprouting.

Effect of the general rise in the value of all timber products in its relation to desirability of holding woodlands and keeping them productive. How a forest tract may supply timber yearly for many years and meanwhile increase in value and be worth more at the end of a long period.

Growing timber as a bank account upon which the owners may draw repeatedly without diminishing the capital. A good form of property to be handed down to the children as an inheritance.

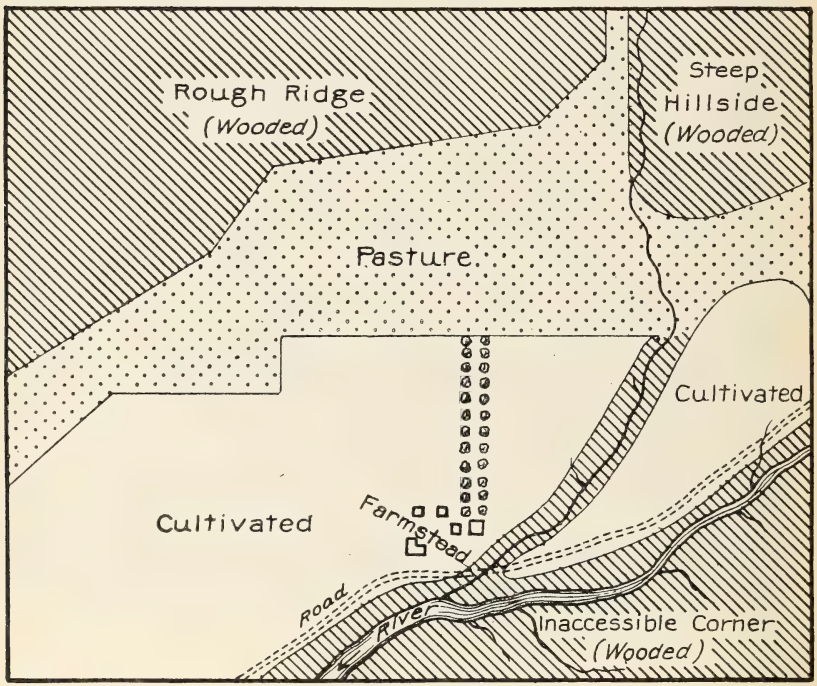

FIG. 19.—Rough, steep, and poor lands and inaccessible parts of the farm increasing farm income by growing trees in permanent woodlands

Keeping fire out of the woods, cutting the trees carefully, and finding the best markets for excess timber products not needed on the farm are indications of sound judgment in farm management.

Practical exercises.—A survey of the methods of caring for the farm forest should be made. This survey should inquire into the general practice of the district in the care of the forest, the forest products marketed, the utilization of waste or idle lands for forest tracts, the practice of replanting forest plats, and the general relation of the acreage in forest to the crop and pasture acreage. From this survey many facts will be obtained for class discussion in forest management. A field trip into some of the farm woodlands of the district is desirable where the studies made first-hand should include the farm practice on the care of the forest.

SUPPLEMENT

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE RELATING TO FORESTRY ON FARM WOODLANDS

DIRECTIONS FOR REQUESTING THESE PUBLICATIONS

(*a*) For publications available for free distribution, application should be made to Director, Office of Publications, U. S. Department of Agriculture, Washington, D. C. (*b*) For publications for sale, application should be made to the Superintendent of Documents, Government Printing Office, Washington, D. C., inclosing the money in the form of cash or money order (stamps not accepted).

The following lists are subject to frequent changes as available supplies become exhausted and new publications are added:

FARMERS' BULLETINS AVAILABLE FOR FREE DISTRIBUTION

622. Basket Willow Culture.
744. Preservative Treatment of Farm Timbers.
745. Waste Land and Wasted Land on Farms.
1023. Machinery for Cutting Firewood.
1071. Making Woodlands Profitable in the Southern States.
1100. Cooperative Marketing of Woodland Products.
1117. Forestry and Farm Income.
1123. Growing and Planting Hardwood Seedlings on the Farm.
1177. Care and Improvement of the Farm Woods.
1188. The Southern Pine Beetle.
1210. Measuring and Marketing Farm Timber.
1256. Slash Pine.
1312. Tree Planting in the Great Plains Region.
1366. Production of Maple Sugar and Sirup.
1405. The Windbreak as a Farm Asset.

OTHER DEPARTMENT PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION

Forestry Bulletin 111, Lightning in Relation to Forest Fires.
Forestry Bulletin 114, Forestry Conditions in Louisiana.
Department Bulletin 152, The Eastern Hemlock.
Yearbook Separate 548, Fire Prevention and Control on the National Forests.
Yearbook Separate 688, Farms, Forests, and Erosion.
Department Circular 211, Government Forest Work.
Forestry Circular 205, Forest Fire Protection Under Weeks Law in Cooperation with the States.

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS

Farmers' Bulletin 134, Tree Planting for Rural School Grounds. Price 5 cents.
Farmers' Bulletin 173, Primer of Forestry, Part I. Price 5 cents.
Farmers' Bulletin 358, Primer of Forestry, Part II. Price 5 cents.
Farmers' Bulletin 423, Forest Nurseries for Schools. Price 5 cents.
Farmers' Bulletin 582, Uses for Chestnut Timber Killed by the Bark Disease. Price 5 cents.
Forestry Bulletin 17, Check List of the Forest Trees of the United States. Price 15 cents.
Forestry Bulletin 36, The Woodsman's Handbook. Price 25 cents.
Forestry Bulletin 58, The Red Gum. Price 15 cents.
Forestry Bulletin 61, Terms Used in Forestry and Logging. Price 5 cents.
Forestry Bulletin 92, Light in Relation to Tree Growth. Price 10 cents.

Forestry Bulletin 96, Second Growth Hardwoods in Connecticut. Price 15 cents.
Forestry Bulletin 104, Principles of Drying Lumber. Price 5 cents.
Forestry Bulletin 117, Forest Fires. Price 10 cents.
Forestry Circular 65, Norway Spruce (Planting Leaflet). Price 5 cents.
Forestry Circular 77, Cottonwood (Planting Leaflet). Price 5 cents.
Forestry Circular 92, Green Ash (Planting Leaflet). Price 5 cents.
Forestry Circular 208, Extracting and Cleaning Forest Tree Seed. Price 5 cents.
Department Bulletin 12, Uses of Commercial Woods of the United States, Beech, Birches, Maples. Price 10 cents.
Department Bulletin 13, White Pine under Forest Management. Price 15 cents.
Department Bulletin 55, The Balsam Fir. Price 10 cents.
Department Bulletin 153, Forest Planting in the Eastern United States. Price 10 cents.
Department Bulletin 212, Observations on the Pathology of the Jack Pine. Price 5 cents.
Department Bulletin 247, A Disease of Pines Caused by Cronartium Pyriforme. Price 5 cents.
Department Bulletin 272, The Southern Cypress. Price 20 cents.
Department Bulletin 285, The Northern Hardwood Forest. Price 20 cents.
Department Bulletin 299, The Ashes: Their Characteristics and Management. Price 25 cents.
Department Bulletin 481, Status and Value of Farm Woodlots in the Eastern United States. Price 15 cents.
Department Bulletin 544, The Red Spruce: Its Growth and Management. Price 20 cents.
Department Bulletin 605, Lumber Used in the Manufacture of Wooden Products. Price 5 cents.
Department Bulletin 638, Forestry and Community Development. Price 10 cents.
Department Bulletin 683, Utilization of Elm. Price 10 cents.
Department Bulletin 718, Small Sawmills. Price 10 cents.
Department Bulletin 753, Use of Wood for Fuel. Price 10 cents.
Department Bulletin 787, Protection from the Locust Borer. Price 5 cents.
Department Bulletin 1061, Longleaf Pine. Price 25 cents.
Department Circular 64, How Lumber is Graded. Price 5 cents.
Yearbook Separate 779, Farm Woodlands and the War. Price 5 cents.

STATE FORESTRY DEPARTMENTS

Thirty-three States have departments of forestry, all of which publish more or less material on varied phases of the subject. Applications should be addressed to the State foresters at the following places:

Alabama, State Commission of Forestry, Montgomery.
California, State Board of Forestry, Sacramento.
Colorado, State Board of Forestry, Fort Collins.
Connecticut, State Forester (under Agricultural Experiment Station), New Haven.
Idaho, Fire Warden System (under State Board of Land Commissioners), Boise.
Illinois, State Forester, Urbana.
Indiana, State Board of Forestry, Indianapolis.
Iowa, State Forestry Commissioner, Des Moines.
Kansas, State Agricultural College, Manhattan.
Kentucky, Commissioner of Agriculture, Frankfort.
Louisiana, Department of Conservation, New Orleans.
Maine, Forest Commissioner, Augusta.
Maryland, State Board of Forestry, Baltimore.
Massachusetts, State Forester, Boston.
Michigan, Public Domain Commission, Roscommon.
Minnesota, State Forestry Board, St. Paul.
Montana, State Board of Land Commissioners, Helena.
New Jersey, Department of Conservation and Development, Trenton.
New York, Division of Lands and Forests, Albany.
North Carolina, Geological and Economic Survey, Chapel Hill.
Ohio, Department of Forestry, Wooster.
Oregon, State Board of Forestry, Salem.
Pennsylvania, Department of Forestry, Harrisburg.
Rhode Island, Commissioner of Forestry, Chepachet.

South Dakota, Forest Supervisor, Custer.
Tennessee, State Geological Survey, Nashville.
Texas, Agricultural and Mechanical College, College Station.
Vermont, Department of Agriculture, Montpelier.
Virginia, State Forester, University.
Washington, State Board of Forest Commissioners, Olympia.
West Virginia, Forest, Game, and Fish Department, Philippi.
Wisconsin, State Conservation Commission, Madison.

DOYLE RULE FOR SCALING LOGS[1]

Diameter of log (small end, inside bark)	LENGTH OF LOG IN FEET														
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	BOARD FEET														
Inches															
6	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5
7	3	4	4	5	5	6	7	8	8	9	9	10	10	11	11
8	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
9	9	11	12	14	16	17	19	20	22	23	25	27	28	30	31
10	13	16	18	20	22	25	27	29	31	34	36	38	40	43	45
11	18	21	24	28	31	34	37	40	43	46	49	52	55	58	61
12	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
13	30	35	40	46	51	56	61	66	71	76	81	86	91	96	101
14	37	44	50	56	62	69	75	81	87	94	100	106	112	119	125
15	45	53	60	68	76	83	91	98	106	113	121	129	136	144	151
16	54	63	72	81	90	99	108	117	135	144	144	162	162	171	180
17	63	74	84	95	106	116	127	137	148	158	169	180	190	201	211
18	73	86	98	110	122	133	147	159	171	184	196	208	220	233	245
19	84	98	112	127	141	155	169	183	197	211	225	239	253	267	281
20	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320
21	108	126	144	163	181	199	217	235	253	271	289	307	325	343	361
22	121	142	162	182	202	223	243	263	283	304	324	344	364	385	405
23	135	158	180	203	226	248	271	293	316	338	361	384	406	429	451
24	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500
25	165	193	220	248	276	303	331	358	386	413	441	469	496	524	551
26	181	212	242	272	302	333	363	393	423	454	484	514	544	575	605
27	198	231	264	298	331	364	397	430	463	496	529	562	595	628	661
28	216	252	288	324	360	396	432	468	504	540	576	612	648	684	720
29	234	273	312	352	391	430	469	508	547	586	625	664	702	742	781
30	253	296	338	380	422	465	507	549	591	644	676	718	760	803	845
31	273	319	364	410	456	501	547	592	638	683	729	775	820	866	911
32	294	343	392	441	490	539	588	637	686	735	784	833	882	931	980
33	315	368	420	473	526	578	631	683	736	788	841	894	946	999	1,051
34	337	394	450	506	562	619	675	731	787	844	900	956	1,012	1,069	1,125
35	360	420	480	541	601	661	721	781	841	901	961	1,021	1,081	1,141	1,201
36	384	448	512	576	640	704	768	832	896	960	1,024	1,088	1,152	1,216	1,280
37	408	476	544	613	681	749	817	885	953	1,021	1,089	1,157	1,225	1,293	1,361
38	433	506	578	650	722	795	867	939	1,011	1,084	1,156	1,228	1,300	1,373	1,445
39	459	536	612	689	766	842	919	995	1,072	1,148	1,225	1,302	1,378	1,455	1,531
40	486	567	648	729	810	891	972	1,053	1,134	1,215	1,296	1,377	1,458	1,539	1,620

[1] For information regarding the advisability of using different log scales see U. S. Dept. Agr., Farmers' Bul. 1210.

To find the number of board feet in a log without using the above table according to the Doyle rule: Deduct 4 inches from the diameter of the smaller end, square one-fourth the remainder, and multiply the product by the length in feet.

KEY TO COMMON KINDS OF TREES[1]

The following key is intended only as a guide in the identification of the more common kinds of trees. It is based on prominent, distinctive characteristics which can be readily observed by those who have no special training in botany. Most of the terms used require no explanation.

[1] This key and the following tree descriptions are by William H. Lamb, formerly Scientific Assistant in Dendrology, Forest Service.

To use the key, decide first, by an examination of the leaf, in which of the following seven sections your tree belongs; then turn to that section, and from the descriptions there given determine what kind of tree it is.

	Section
Trees with needles or scalelike leaves, mostly evergreens, bearing cones	I
Trees with broad leaves:	
Leaves simple—	
Alternately attached to twigs—	
With toothed edges	II
Edges neither toothed nor notched	III
Opposite on twigs—	
With toothed edges	IV
Edges neither toothed nor notched	V
Leaves compound—	
Alternately attached to twigs	VI
Opposite on twigs	VII

THE CONIFEROUS[2] TREES

I. Trees with Needle or Scalelike Leaves, Mostly Evergreen, Bearing Cones

A. Leaves needle-shaped:
- (1) Leaves clustered—
  - (*a*) Leaves long, from 1 to 18 inches, 2 to 5 in a cluster. Cones large, with many thick, woody scales (Pinus) Pine.
  - (*b*) Leaves short (less than 2 inches long) in brushlike clusters of 12 to 40, falling off in late autumn or early winter. Cones very small, with thin scales, remaining on tree for one or more seasons (Larix) Larch.[3]
- (2) Leaves single—
  - (*a*) Leaves scattered around twigs; falling off when dry or dead. Cones elongated, with thin scales. Twigs roughened by leaf-scars.
    - (*x*) Leaves stiff, often sharppointed and more or less foursided (Picea) Spruce.
    - (*y*) Leaves soft, flat, rounded, or notched at ends, the bases abruptly contracted into threadlike stems (Tsuga) Hemlock.
  - (*b*) Leaves in two distinct rows, one on each side of the twig; falling off in late autumn or early winter. Cones small, ball-like (Taxodium) Bald cypress.
  - (*c*) Leaves often in two rows on the sides of the twigs of lower branches and mostly flat, those on upper branches stouter and arranged on the sides and tops of the twigs. Cones long, erect, produced only on upper side of topmost branches; the scales falling off in autumn, leaving spike-like central axes of the cones attached (Abies) Fir.

B. Leaves scalelike, pointed, overlapping, closely forming flat or four-sided twigs.
- (1) Twigs four-sided. Cones spherical or ball-like, with small, thick scales armed with a spurlike point; seed with very narrow, hard wings (Cupressus) Cypress.
- (2) Twigs flattened.
  - (*a*) Cones elongated, with only a few thin scales; bent back on branches (Thuja) Arborvitæ.
  - (*b*) Cones spherical, very small, berrylike, with thin scales armed with a tiny point; seeds with a broad, thin wing on two sides (Chamæcyparis) Cedar.
  - (*c*) Cones berrylike (showing indistinct outlines of, but no separation into, scaly parts). Leaves either short, scale-like, and sharpjointed, or much longer, needlelike, standing out loosely, and attached in pairs or in threes on the twigs (Juniperus) Juniper.

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[2] Cone-bearing.

[3] The larches are peculiar in having single, scattered leaves on the new or terminal twigs produced each season. These should not be mistaken for the "single" leaves borne throughout by other kinds of evergreens.

THE BROADLEAF TREES

II. Leaves Simple, Alternate, Lobed, and with Toothed Edges, or only with Smooth or Coarsely Toothed Edges

A. Leaves deeply lobed, or with large notches.
  (1) Leaves as wide as they are long. Fruit, a swinging ball, 1 to 1½ inches in diameter.
    (*a*) Leaves with finely toothed margins; star-shaped, the divisions pointed. Fruit, burlike balls, from which, when ripe, small, winged seeds may be shaken. Bark rough. (Liquidambar) Sweet gum.
    (*b*) Leaves with smooth margins, 3 to 5 inches long, pointed lobes, the space between the lobes rounded. Fruit, a rough ball, easily broken when ripe; composed of closely packed, long, narrow seeds which have hairlike bristles at their lower ends and are attached to a bulletlike central part. Old bark of trunks and large limbs peeling off in thin, curled pieces, leaving pale inner bark showing in irregular patches.....(Platanus) Sycamore.
  (2) Leaves longer than wide.
    (*a*) Leaves large, with deep, roundtopped, or with pointed bristletipped lobes, or only with coarse marginal teeth. Fruit, an acorn, resting in a separable cup. (Quercus) Oak.
    (*b*) Leaves small, with little sharp teeth on margin. Twigs bearing sharp thorns. Fruit small (like a little apple), spherical, with bony seeds.....(Cratægus) Hawthorn.

B. Leaves one-sided (one side of leaf shorter at base than the other side).
  (1) Leaves large, oval, 5 to 10 inches long, heart-shaped. Fruit, a cluster of small, woody balls ⅛ to ½ inch in diameter, hanging from a narrow, leaflike blade.....(Tilia) Basswood.
  (2) Leaves 3-veined at base, with long, tapering points, which generally turn to one side; edges smooth, or with small teeth of uniform size. Fruit, a small berry about ¼ inch in diameter. (Celtis) Hackberry.
  (3) Leaves with straight lateral veins, oval; edges double toothed (little teeth on the larger ones). Fruit in clusters, dry, flat, with papery wings all around the seeds.....(Ulmus) Elm.

C. Leaves even sided (both sides of leaf the same length).
  (1) Leaves oval, evergreen, thick, with short needlelike teeth. Fruit, a bright red berry.....(Ilex) Holly.
  (2) Leaves more or less elongated, deciduous, with one tooth at the end of each side vein.
    (*a*) Trees with smooth, bluish-gray bark, and long, pointed, chestnut-brown buds. Fruit, a small, three-cornered nut, in a spiny husk which splits open at the top into three parts.....(Fagus) Beech.
    (*b*) Trees with ridged, grayish-brown bark. Fruit, large, spherical, covered with dense, needlelike spines; splits open from the top into 3 or 4 divisions, and containing several thin-shelled, chestnut-brown nuts. (Castanea) Chestnut.
  (3) Leaves very narrow, long, pointed, finely toothed. Small branches slender, usually tough. Fruit, a long cluster of little pods filled with "cotton" (seeds).....(Salix) Willow.
  (4) Leaves somewhat triangular in outline, broad at base, pointed, toothed. Buds of some species coated with aromatic gum. Branches coarse. Fruit, a long cluster of little pods filled with "cotton" (seeds).....(Populus) Poplar.

C. Leaves even sided—Continued.
(5) Leaves oval, pointed, with sawlike teeth.
(*a*) Fruit a tiny scaly cone.
(*x*) Bark of trunk and branches peeling off in thin papery sheets. Leaves double toothed (little teeth on the larger ones.) Fruit ("cones") borne singly, pendulous, scaly, falling apart when ripe; seeds with gauzelike wings on two sides.....(Betula) Birch.
(*y*) Bark smooth or broken, but not peeling. Leaves with small teeth. "Cones" several in a cluster on stiff, upright stems, hard, woody, not falling apart; seed with narrow wings on two sides. (Alnus) Alder.
(*b*) Fruit, a berry; fleshy, edible.
(*x*) Leaves large, 3-veined at base, often irregularly, deeply lobed; containing milky juice. Fruit similar in appearance to a blackberry. (Morus) Mulberry.
(*y*) Leaves small or medium sized, feather-veined; containing green juice; fruit (cherry or plum) with one hard-shelled, flattened or spherical seed.
(*i*) Seed ("stone") flattened. Fruit large and short-stemmed.....(Prunus) Plum.
(*ii*) Seed spherical. Fruit small and long-stemmed.....(Prunus) Cherry.

III. Leaves Simple, Alternate, Regularly or Irregularly Lobed, Edge Neither Toothed nor Notched

A. Leaves with deep lobes.
(1) Leaves with blunt ends (appearing as if cut off), and with two, pointed, side lobes. Flowers tuliplike. Fruit conelike, pointed, upright, composed of long, thin, overlapping, winged seeds. Bruised twigs have a peppery odor.. (Liriodendron) Tulip Poplar.
(2) Leaves with rounded ends; oval, often with a lobe on one side, making the leaf mitten-shaped, or sometimes with a lobe on each side. Bruised twigs and inner bark of trunk sweet-smelling. (Sassafras) Sassafras.

B. Leaves without lobes.
(1) Bruised twigs with peppery odor.
(*a*) Leaves oval (evergreen in one species) or elongated, pointed, large. Flowers large, at ends of branches. Fruit conelike, with a bright red seed in each division. (Magnolia) Magnolia.
(2) Bruised twigs without peppery odor.
(*a*) Leaves broader at top than at the base, 8 to 12 inches long, with very short leafstalk. Fruit fleshy, edible, elongated, 3 to 4 inches long, with thick, yellowish, smooth skin when ripe, and large, bony, flat seeds. Buds brown and hairy.....(Asimina) Papaw.
(*b*) Leaves broadest at middle, oval, 3 to 10 inches long.
(*x*) Fruit short-stalked, spherical, 1 to 1½ inches in diameter; when ripe pale orange color, surrounded at base with old flower-cup; very bitter, but edible after frost. (Diospyros) Persimmon.
(*y*) Fruit long-stalked, elongated or spherical, solitary or in pairs, with thin flesh and a ridged stone or seed.....(Nyssa) Gum or Tupelo.
(*c*) Leaves rounded or heart-shaped, 3 to 5 inches across. Flowers pealike, pink, appearing before the leaves. Fruit, a dry flat pod, 2½ to 3½ inches long; in dense clusters on sides of branches; seeds, hard, small, oblong, ¼ inch long.....(Cercis) Redbud.
(3) Bruised or cut twigs and leaves with milky juice.
(*a*) Leaves with narrow points. Twigs bearing thorns. Fruit large, orangelike, with smooth, uneven surface, 4 to 6 inches in diameter.....(Toxylon) Osage orange.

IV. Leaves Simple, Opposite, with Lobe-Toothed Edges

A. Leaves with large (often lobelike) teeth. Fruit in pairs, each part with a conspicuous, flat, very thin wing. Fruit matures in spring or in autumn, when it becomes dry and yellowish-brown---------- (Acer) Maple.

V. Leaves Simple, Opposite, Edges Neither Toothed nor Notched

A. Leaves very large, heart-shaped, long-pointed. Flowers showy, trumpet-like, in large upright clusters. Fruit, a long, cylindrical pod, 6 to 14 inches long, containing closely packed, flat, dry seeds, with fringed wings at each end---------- (Catalpa) Catalpa.

B. Leaves rather small, oval, tapering at base and point. Flowers conspicuous, white (occasionally rosy), appearing with the expanding leaves. Fruit, a small cluster of two-seeded berries, turning red in autumn.
(Cornus) Dogwood.

VI. Leaves Compound, Alternately Attached to Twigs

A. Leaflets small, many, attached along two sides of a main stem. Fruit, a flat, bean, dry or fleshy pod.
   (1) Leaflets with small, wavy teeth. Pods flat, broad, long, often twisted, thin-skinned, with thick, cheesy, sweetish pulp about seeds. Trees with long, keen, branched thorns on the trunk.
(Gleditsia) Honey locust.
   (2) Leaflets not toothed.
      (*a*) Twigs with pairs of short, keen thorns. Leaflets oblong, rounded at ends. Flowers showy white, in large clusters. Pods small, flat, thin, dry, with small seeds.
(Robinia) Black locust.
      (*b*) Twigs stout, thornless. Leaflets oval, pointed. Flowers greenish, with violet odor. Pods large, flat, thick, with greenish, jellylike pulp (poisonous) around the large, black-brown seeds---------- (Gymnocladus) Coffee tree.

B. Leaflets large. Fruit, spherical, with a separable or inseparable husk, containing a hard-shelled nut.
   (1) Leaflets narrow at base becoming larger at outer end. Nut light-colored, smooth, in a husk which separates more or less completely into four parts when ripe---------- (Hicoria) Hickory.
   (2) Leaflets broader at base, becoming narrower at outer end. Nut dark, rough, in a fleshy husk which is inseparable by natural divisions and turns black when old. Pith of twigs forms numerous cross-partitions---------- (Juglans) Walnut.

VII. Leaves Compound, Opposite on Twigs

A. Leaflets arranged along two sides of a main leafstalk, with a leaflet at the end.
   (1) Leaflets generally 3 (sometimes 5), toothed only near the ends. Fruit, a cluster of dry, winged seeds, arranged in pairs like those of maple---------- (Acer) Boxelder.[4]
   (2) Leaflets generally more than 3 (3 to 11), and either not toothed or with small teeth. Fruit, a cluster of single-winged, dry, oar-shaped "seeds"---------- (Fraxinus) Ash.

B. Leaflets (5 to 9) clustered at end of a main leaf-stem. Fruit, with a thick, warty or prickly husk, which separates into several parts, containing a shiny brown nut---------- (Æsculus) Buckeye.

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[4] Boxelder, a true maple, differs from the others in having compound leaves.

ONE HUNDRED EASTERN FOREST TREES [5]

Name	Distribution [6]	Characteristics
1. White pine (*Pinus strobus*)	Northeastern and Lake States and Appalachian Mountains.	Fine timber tree; leaves in clusters of 5, 3 to 5 inches long.
2. Jack pine (*Pinus banksiana*)	Northern tree, best growth north of Lake Superior.	Common on sandy soil; leaves in clusters of 2, ¾ to 1¼ inches long.
3. Red or Norway pine (*Pinus resinosa*).	Northern tree, associated with white pine.	Leaves in clusters of 2, 5 to 6 inches long.
4. Pitch pine (*Pinus rigida*)	Northeastern and middle Atlantic States.	Leaves in clusters of 3, 3 to 5 inches long.
5. Loblolly pine (*Pinus tæda*)	Southeastern United States—Coastal plain, New Jersey to Texas.	Leaves in clusters of 3, 6 to 9 inches long. Cone, 2 to 3 inches in diameter
6. Shortleaf pine (*Pinus echinata*).	Middle Atlantic and Southern States, with hardwood trees. Piedmont uplands, New Jersey to Texas.	Leaves in clusters of 2 and sometimes 3, 3 to 5 inches long. Cone small, 1 to 2 inches in diameter.
7. Spruce pine (*Pinus glabra*)	Southeastern States	Leaves in clusters of 2, 1½ to 3 inches long.
8. Virginia pine (Scrub pine) (*Pinus virginiana*).	Middle Atlantic States to Indiana.	Do.
9. Pond pine (*Pinus rigida serotina*).	Southeastern States in Coastal Plain. Scattered.	Leaves 6 to 8 inches long, tree similar to pitch pine but cones remain closed for several years. Cone egg-shaped.
10. Slash pine (Cuban pine) (*Pinus caribaea*).	Southeastern and Gulf States, in poorly drained soils; uplands in Georgia, associated with longleaf pine.	Leaves in clusters of 2, sometimes 3, 8 to 12 inches long. Important turpentine tree.
11. Longleaf pine (*Pinus palustris*).	South Atlantic and Gulf States.	Leaves in clusters of 3, 8 to 18 inches long. Important turpentine tree.
12. Tamarack or Larch (*Lariz laricina*).	Northeastern and Lake States and in Canada to Alaska; best growth in Canada.	Leaves needle-shape, ¾ to 1¼ inches long, in dense, brush-like clusters; falling off in winter.
13. White spruce (*Picea glauca*)	Northeastern and Lake States and Canada.	Leaves ⅓ to ¾ inch long, arranged singly around the smooth twigs; whitish.
14. Black spruce (*Picea mariana*)	Northeastern and Lake States and in Canada to Alaska.	Similar to white spruce, but twigs are minutely hairy; cones strongly attached.
15. Red spruce (*Picea rubra*)	Northeastern States, Canada, and Appalachian Mountains	Similar to black spruce, but cones begin to fall when ripe.
16. Hemlock (*Tsuga canadensis*)	Northern and Eastern States and in mountains to Georgia.	Leaves ½ to ⅔ inch long, attached by tiny leafstalks; cones ½ to ¾ inch long.
17. Southern cypress (*Taxodium distichum*).	South Atlantic and Gulf States; in swamps.	Leaves ½ to ¾ inch long, falling off in winter; cones ball-like.
18. Balsam fir (*Abies balsamea*)	Northeastern and Lake States to southwest Virginia.	Leaves ½ to 1¼ inches long; cones upright, falling to pieces when ripe.
19. Southern balsam fir (*Abies fraseri*).	High southern Appalachian Mountains.	Similar to balsam fir, except that the cones are covered with protruding scaly bracts.
20. Northern white cedar (*Thuja occidentalis*).	Northeastern and Lake States and eastern Canada.	Leaves scale-like; cones ⅓ to ½ inch long, bent backward on twigs, which are flat.
21. Southern white cedar (*Chamaecyparis thyoides*).	Swamps of eastern and Gulf Coast States.	Cones ball-like; leaves somewhat resembling arborvitæ.
22. Red cedar (*Juniperus virginiana*).	Eastern United States	Leaves scale-like, those on young shoots and seedlings awl-shaped and spreading; young cones changed into a firm berry.
23. Red gum (*Liquidambar styraciflua.*)	Central and Southeastern United States.	Leaves star-shape; fruit a bur-like ball suspended by a long stalk.
24. Sycamore (*Platanus occidentalis*).	Eastern United States	Leaves broad and coarsely toothed; base of leafstalk inclosing a winter bud in peculiar manner; fruit a hard-surfaced, long-stalked ball.
25. White oak (*Quercus alba*)	——do	Leaves deeply lobed, not bristle-tipped; acorns ripening in one season.
26. Bur oak (*Quercus macrocarpa*).	Central and Northeastern United States to the Dakotas, Nebraska, and Texas.	A white oak with fringe-edged acorn and larger leaves more deeply lobed.
27. Overcup oak (*Quercus lyrata*)	Southeastern United States	A white oak with acorns completely or almost covered by the thin cup.
28. Post oak (*Quercus stellata*)	Eastern United States	A white oak with leaves cut deeply above and below the middle lobes, forming the suggestion of a cross.

[5] Eastern half of United States. Most of these are important as commercial timber trees; a few, however, are small sized and included because of their botanical importance and wide occurrence in mixture with timber trees, particularly in second-growth forests.

[6] Stated only in very general terms. More detailed descriptions of the ranges of trees in this list, and of all the trees indigenous to the United States and Canada, will be found in Check List of the Forest Trees of the United States. (Forestry Bulletin 17.)

ONE HUNDRED EASTERN FOREST TREES—Continued

Name	Distribution	Characteristics
29. Chestnut oak (*Quercus montana*).	Northeastern United States and Appalachian Mountains. Common on ridges.	A white oak with leaves resembling those of the chestnut, and with long, large, shallow-cupped acorns.
30. Red oak (*Quercus borealis maxima*).	Eastern United States	Leaves deeply cut, with bristle-tipped points; acorns ripening in 2 seasons; large, with very shallow cups.
31. Black oak (*Quercus velutina*)	do	An oak with thicker, large, glossy leaves which are more or less minutely woolly beneath; acorns with small cups, as deep or deeper than wide.
32. Pin oak (*Quercus palustris*)	do	A red oak with smaller leaves and smaller and shallower cupped striped acorns.
33. Southern red or Spanish oak (*Quercus rubra*).	Central and Southeastern States.	A red oak with leaves very deeply cut, the upper central portion being very narrow and sometimes slightly curved, and with dense, tawny-yellow wool beneath.
34. Water oak (*Quercus nigra*)	Southeastern United States	A red oak; leaves not toothed, small, tapering from broad top-end to the base; sometimes 3-lobed. Small acorns with shallow cup. Much planted as street trees throughout South.
35. Willow oak (*Quercus phellos*)	Eastern United States	A red oak with leaves resembling a smooth-edged willow or peach leaf. Much planted as street shade tree in Middle Atlantic and Southern States.
36. Live oak (*Quercus virginiana*)	South Atlantic and Gulf States.	An evergreen oak with narrow, smooth-bordered leaves which are turned under on the edge and pale-woolly beneath and glossy above; small, pointed acorns with long stalks.
37. Basswood (*Tilia glabra*)	Northeastern United States	Leaves smooth, broadly heart-shaped with finely toothed edge; fruit a cluster of little woody balls suspended from the middle of a long narrow leaf-like bract.
38. White basswood (*Tilia heterophylla*).	Middle and South Atlantic States.	Similar to basswood except that the leaves are whitish (or minutely woolly) beneath.
39. Hackberry (*Celtis occidentalis*).	Middle Atlantic States to the Dakotas, Kansas, and Missouri.	Leaves finely toothed, long pointed; fruit a long-stalked, single-seeded berry with very thin, sweetish flesh.
40. American elm (*Ulmus americana*).	Eastern United States	Leaves sharply toothed; fruit flat, papery, about ½ inch long, fringed around with tiny hairs.
41. Slippery elm (*Ulmus fulva*)	do	Long leaves, very rough on the upper side; inner bark is slippery when chewed, and the flat fruits have a smooth edge.
42. Cork elm (*Ulmus racemosa*)	Northeastern United States	Differing from other elms in having fruit minutely hairy all over, and twigs with conspicuous, corky ridges.
43. Holly (*Ilex opaca*)	Eastern United States	Evergreen tree, the leaves having spiny teeth, and fruit a bright red berry, remaining attached through the winter.
44. Beech (*Fagus grandifolia*)	do	Leaves with saw-tooth edge; fruit a light brown spine-covered bur containing a 3-cornered brown nut.
45. Chestnut (*Castanea dentata*)	Northeastern and Middle Atlantic States.	Long narrow leaves with sharp, forward-pointing teeth; fruit a spherical, spiny bur containing several brown nuts. A plant disease is rapidly killing chestnut.
46. Chinquapin (*Castanea pumila*).	Middle and Southern States	Leaves smaller than chestnut and finely woolly beneath; but one nut in the spiny husk. Mostly known as a shrub, but reaches tree size.
47. Black willow (*Salix nigra*)	Eastern United States	Leaves slender, long-pointed, and finely toothed. The largest of our eastern willows, difficult to distinguish from other willows.
48. Balsam poplar (*Populus balsamifera*).	Northern United States	Large leaves, very broad at base, toothed, whitish beneath, with round leafstalk.
49. Cottonwood (*Populus deltoides*).	Northeastern United States	Leaves triangular, long-pointed, toothed, smooth, with flattened leafstalk.

ONE HUNDRED EASTERN FOREST TREES—Continued

Name	Distribution	Characteristics
50. Swamp cottonwood (*Populus heterophylla*).	South Atlantic and Gulf States	Heart-shaped leaves with round leafstalk, minutely woolly on underside when young; smooth later.
51. Aspen (*Populus tremuloides.*)	Northern and Western United States.	Leaves broad, finely toothed, leafstalks flat, longer than blades.
52. Large-tooth aspen (*Populus grandidentata*).	Northeastern United States.	Leaves broad, coarsely toothed, with flattened leafstalks.
53. Paper birch (*Betula papyrifera*).	Northern United States	Leaves broad at base, finely toothed, fruit a papery cone which falls apart when ripe; white bark peeling off in thin sheets.
54. Sweet birch (*Betula lenta*)	Northeastern United States	Bark dark brown, hard and close, not peeling off in sheets; tiny scales of cones smooth, not minutely hairy along edges as in yellow birch.
55. Yellow birch (*Betula lutea*)	Eastern United States	Bark yellow-gray; tiny scales of the cones minutely hairy along edges.
56. Red mulberry (*Morus rubra*).	do	Leaves large, heart-shaped, sharply toothed; fruit red or black, blackberrylike.
57. Wild plum (*Prunus americana*).	do	Leaves conspicuously veiny, pointed, finely toothed; fruit red or yellow with short stalks; branches with spinelike twigs. Small tree.
58. Wild red cherry (*Prunus pennsylvanica*).	do	Smooth red-brown bark; leaves resemble those of the peach; fruit bright red when ripe, long-stalked in clusters of 3 to 5.
59. Choke cherry (*Prunus virginiana*).	do	Fruit in a long cluster, ripe berries glossy black, bitterish, producing a puckering sensation in the mouth.
60. Black cherry (*Prunus serotina*).	do	Fruit resembles choke cherry, but smaller and thin-fleshed.
61. Yellow poplar (*Liriodendron tulipifera*).	do	Leaves large, blunt or with deep notch at end; flowers large yellow; tulip-like; fruit a woody, upright cone.
62. Sassafras (*Sassafras officinale*).	do	Leaves oval with one lobe like a "mitten," or with a lobe on each side. Twigs and inner bark fragrant.
63. Black gum (*Nyssa sylvatica*)	Eastern United States	Large tree; leaves oval with smooth edge. Fruit an elongated black berry with seed but little flattened and scarcely ridged.
64. Swamp black gum (*Nyssa biflora*).	Southern States	Small tree; resembling black gum, but fruit, which also grows in pairs, has a flattened and ridged stone.
65. Tupelo gum (*Nyssa aquatica*). Known also as cotton gum. Associated with cypress.	Swamps of Southeastern Coastal States.	Large tree; fruits produced singly, with a stalk longer than the fruit; stone of fruit sharp-edged or winged.
66. Sour tupelo gum (*Nyssa ogeche*).	Swamps, South Carolina to Florida.	Small tree; resembling tupelo gum, but fruits with stalks shorter than the fruit itself.
67. Sweet bay (*Magnolia virginiana*). Known also as sweet magnolia.	Coastal swamps, Southeastern and Gulf States.	Small flowers, white, fragrant. Leaves silky-white beneath.
68. Cucumber-tree (*Magnolia acuminata*).	Eastern United States	Leaves large, oval, smooth-bordered, pointed; flowers greenish yellow; fruit slender.
69. Mountain magnolia (*Magnolia fraseri*).	Southeastern States	Flowers white; leaves deeply lobed at base, forming "ears."
70. Bigleaf magnolia (*Magnolia macrophylla*).	do	Flowers large, white; leaves very large, with "ears" at base, and white beneath. Largest leaved tree in North America (20 to 30 inches long).
71. Persimmon (*Diospyros virginiana*).	Eastern United States	Leaves oval, smooth, with smooth margin; fruit orange colored, 1 to 1½ inches in diameter, edible in late fall after frost.
72. Redbud (*Cercis canadensis*)	do	Leaves heart-shaped, smooth margin: fruit a pealike pod in clusters of 4 to 8; flowers resembling a small rose-colored sweet pea.
73. Osage orange (*Toxylon pomiferum*).	Native to Arkansas, eastern Oklahoma, and Texas, but widely planted throughout eastern United States.	Glossy leaves with smooth edges; fruit a heavy ball, resembling an orange, 4 to 5 inches in diameter, milky juice.
74. Sugar maple (*Acer saccharum*).	Eastern United States	Leaves 3 to 5 lobed with large rounded teeth; fruit a pair of keys ripening in autumn. Yields maple sugar.

ONE HUNDRED EASTERN FOREST TREES—Continued

Name	Distribution [6]	Characteristics
75. Silver maple (*Acer saccharinum*).	Eastern United States	Leaves deeply 5-lobed, with sharp irregular teeth; fruit ripening in spring before appearance of leaves. Yields maple sugar.
76. Red maple (*Acer rubrum*)	do	Leaves 3 to 5 lobed, finely toothed; reddish fruit ripening in spring or early summer. Yields maple sugar.
77. Boxelder (*Acer negundo*, including 6 varietal forms).	Throughout United States	Leaves compound, the leaflets toothed; fruit ripening in early summer and remaining on trees during winter.
78. Hardy catalpa (*Catalpa speciosa*).	South Central States, widely cultivated elsewhere.	Leaves large, heart-shaped; fruit a long "pod" filled with flat seeds which are tufted at each end. A better shaped tree than common catalpa (*Catalpa bignonioides*).
79. Dogwood (*Cornus florida*)	Eastern United States	Leaves mostly clustered at ends of branches, with slightly wavy margins; flowers white with four large bracts resembling petals. Leaves opposite.
80. Blue dogwood (*Cornus alternifolia*).	Northeastern States and Appalachian Mountains.	Leaves resembling those of flowering dogwood, but alternate in arrangement; white flowers without the four large petallike bracts.
81. Honey locust (*Gleditsia triacanthos*).	Central States and Minnesota to Texas. Widely cultivated elsewhere.	Leaves doubly-compound, the leaflets with slightly wavy margins; fruit a flat pod a foot or more in length, twisted when dry. Trees with large branching thorns.
82. Black locust (*Robinia pseudacacia*).	Appalachian region, widely cultivated and naturalized all over United States.	Leaves compound, leaflets with smooth margins; fruit a pod 3 to 4 inches long. Trees with pairs of short thorns at the base of leaves and twigs. Wood heavy and durable in the ground.
83. Kentucky coffee-tree (*Gymnocladus dioicus*).	Mainly in Ohio and Mississippi Valleys.	Leaves doubly compound, the pointed leaflets with entire margins; fruit a large, woody, wide pod, 6 to 10 inches long, 1½ to 2 inches wide containing a greenish jelly, which is poisonous. Trees without thorns.
84. Pecan (*Hicoria pecan*)	Mississippi Valley	Bud scales few, shell of nut thin, husk wing-ridged, with large cavities; nuts elongated with sweet kernel.
85. Bitternut hickory (*Hicoria cordiformis*).	Eastern United States	Nut broader than long, without angles, very thin shelled; bitter kernel, husk thin.
86. Water hickory (*Hicoria aquatica*).	Gulf States and Lower Mississippi Valley.	Nut broad, with bitter kernel.
87. Shagbark hickory (*Hicoria ovata*).	Eastern United States	Buds with many scales (all of the preceding hickories have buds with few scales); bark loosening from trees in shaggy strips.
88. Big nut shagbark hickory (*Hicoria laciniosa*).	do	Leaves large; large, angled, thick-shelled nuts with thick husks splitting to the base; bark shaggy as in preceding.
89. Mockernut hickory (*Hicoria alba*).	do	Leaves large, hairy; buds large, bud-scales many; bark closely furrowed, not separating from the trunk. Nut with thick husk, large, angled, thick-shelled.
90. Pignut hickory (*Hicoria glabra*).	do	Leaves small, smooth; fruit abruptly tapering at base to thick stem (resembling a small fig); husk barely splitting at top end and usually retaining the nut.
91. Black walnut (*Juglans nigra*)	Eastern United States	Leaves compound with toothed edges; spherical fruit growing singly or in pairs; bark brown, furrowed.
92. Butternut (*Juglans cinerea*)	do	Leaves compound, with toothed edges; fruit in hanging clusters of 3 to 5, pointed and elongated, with viscid hairs when young. Velvety cushion just above leaf-scar; bark gray and smooth on young trees.
93. White ash (*Fraxinus americana*).	do	Smooth twigs, opposite; leaves compound, leaflets toothed or wavy on the margins and paler beneath; seed with a plump, well-rounded body and a wing extending almost entirely from the end and borne in dense clusters. High-ground tree.

ONE HUNDRED EASTERN FOREST TREES—Continued

Name	Distribution	Characteristics
94. Red ash (*Fraxinus pennsylvanica*).	Eastern United States	Differs from white ash in having young twigs and leaflets (beneath) velvety and wing of seed extending down along sides of seed body, which is narrow. A low-ground tree.
95. Green ash (*Fraxinus pennsylvanica lanceolata*).	do	Like the preceding, except twigs are smooth, leaflets sharply toothed; body of seed and pointed wing very narrow. Low-ground tree.
96. Pumpkin ash (*Fraxinus profunda*).	Southern States	Resembling red ash, but seeds are very much larger, sometimes twice the size. Swamp tree.
97. Black ash (*Fraxinus nigra*)	Northern and Lake States	Leaflets stemless, finely toothed, 7 to 11; seeds with a flat, wide wing, which extends conspicuously down the sides of the seed body and is blunt. Swamp tree.
98. Water ash (*Fraxinus caroliniana*).	Southeastern States	Leaflets oval-elongated, barely pointed; seeds with a very broad, short-pointed wing. Swamp tree, often on inundated river swamps.
99. Ohio buckeye (*Aesculus glabra*).	Ohio and Mississippi Valleys	Leaves palmately compound like horse-chestnut; fruit knobby, prickly, spherical. Small tree.
100. Yellow buckeye (*Aesculus octandra*).	do	Leaves resembling the preceding, but fruit smooth. Large tree (90 feet high).

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